



FAST TRACK ACTION PLAN FOR DISTRIBUTION OF INTERNATIONAL BROADBAND CONNECTIVITY IN URBAN AND RURAL LIBERIA

USAID GOVERNANCE AND ECONOMIC ASSISTANCE
PROGRAM (GEMAP)

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EXECUTIVE SUMMARY AND CONCLUSIONS

The high speed international broadband access provided by ACE will provide only limited benefits to Liberia unless specific steps are taken rapidly to develop distribution infrastructure and prepare Liberians to make full use of this to access broadband services. In essence, there are two phases to ensure that Liberians obtain effective international broadband access:

- Phase I: launch ACE service in Liberia in late 2012 through membership in the ACE consortium and construction of a Monrovia Landing Point for the cable; and
- Phase II: ensure this service reaches a broad range of Liberians across the population at sufficiently low cost to encourage increased take up and thereby facilitate participation by Liberians in the global information society. It will therefore be critical that facilities and infrastructure be in place in Liberia to connect main demand centers to the landing station when ACE services are launched.

The most common reasons why broadband services are not widely used in many countries are that there is no access available, quality is poor, the cost is prohibitive, or consumers are not familiar with technology or the internet, and therefore they do not make use of it. The last example is commonly referred to as the “urban-rural” or “digital” divide.

Liberia is no different. High speed international broadband services are currently available to only a limited number of Liberians, NGOs, larger businesses, GoL entities and others who obtain international access at very high cost via VSAT service (in the range of \$3,000 to \$7,000 per month per megabit. This Fast Track Action Plan for Distribution of International Broadband Connectivity in Urban and Rural Liberia (the Fast Track Action Plan) provides a phased Action Implementation Plan to distribute ACE submarine cable capacity expected in late 2012 (and capacity from secondary connectivity sources) throughout Liberia and to help eliminate the current Urban – Rural (or Digital) Divide.

This report has been structured in short chapters supported by detailed appendices.

The IBI Rapid Assessment Report on ACE Cable Consortium Participation dated March 24, 2010 (the Rapid Assessment Report) analysed options available to Liberia to obtain international broadband connectivity and recommended that Liberia aggressively pursue participation in ACE to obtain a submarine cable landing point in Monrovia.¹ The Rapid Assessment Report was instrumental in Liberia securing financial support from a major international financial institution for the ACE investment and in identifying the components required for a supportive regulatory regime. Following the conclusion of the Rapid Assessment Report, the Cable Consortium of Liberia (CCL) signed the ACE Construction and Maintenance Agreement on June 5, 2010 in Paris, France, securing CCL’s membership in the ACE consortium as a full landing member authorized to build a Landing Point for the ACE cable in Monrovia. ACE services are expected to be launched in late 2012, assuming the proposed construction schedule is met.

The key deliverables in this report are:

¹ Draft Preliminary Report - Rapid Assessment of ACE Cable Consortium Participation, March 24, 2010 Submitted by: William Burnfield, Telecom Strategy, Policy, Regulatory and Investment Expert, and Duncan Sharp, Telecommunications Engineer and ICT Infrastructure. Ministry of Planning & Economic Affairs, Republic of Liberia Governance & Economic Management Assistance Program (GEMAP) IBI-USAID. The report states in the Executive Summary, “Although a number of other alternatives are also available to Liberia to obtain international connectivity, our preliminary assessment indicates that from a timing and availability point of view, full membership in ACE can provide low cost international access to a broad range of Liberians, if accompanied by robust regulation by LTA to ensure competitive pricing releases demand”.

- Background to the subject matter of the report and our approach (Chapter 1)
- Options to distribute broadband access (Chapter 2)
- Options for distributing broadband infrastructure (Chapter 3)
- Cost of providing broadband access as proposed (Chapter 4)
- Sources of potential funding (Chapter 5)
- Identifying obstacles in the Telecommunications Act, 2007, to the provision of rural telecommunications services (Chapters 6 and 7)
- Identify other legal, regulatory, commercial and financial obstacles to telecommunications service, including internet, particularly in rural areas (Chapters 7 and 8)
- Policy recommendations to bridge rural/urban digital divide in Liberia (Chapter 9 and Action Plan)
- Policy and other options to stimulate demand for internet in urban and rural areas in order to encourage commercial provision of internet (Chapters 2, 9 and Action Plan)

The main recommendations of this Fast Track Action Plan are as follows:

1. **Focus near term telecom infrastructure investment on connecting Monrovia to rural county capitals.** Investment in infrastructure within the greater Monrovia area (such as the planned Monrovia fiber optic ring) can largely be financed by operators on a commercial basis as Monrovia represents the most immediate and largest concentration of demand with a broad array of government, NGO, embassy and business internet users.

We have concluded that no subsidies are required by operators to deploy the Monrovia fiber-optic ring required so that Monrovia is broadband-ready as ACE enters service. Libtelco has already initiated construction of a core fiber optic ring to connect six ministries, the university and JFK Hospital, using funding from Ministry of Finance and a donation of cable from Indiana University.

Depending on initial capacity supply and demand, the existing operator microwave systems may be used to “kick start” internet service particularly in Monrovia and in some rural capitals which already have infrastructure. The fiber optic build-out should follow as demand and business case economics dictate and may also be able to explore co-construction with power transmission lines and road/rail developments in and around the capital.

Investment in infrastructure in rural areas outside rural county capitals will, in our view, yield substantially lower benefits than investment in rural capitals, and therefore we recommend that build-out to these areas wait until after rural county capitals are connected, unless special circumstances warrant accelerated build-out (such as the location of rural districts or clans on identified development corridors).

2. **Prioritize infrastructure roll-out along Liberian Development Corridors.** Infrastructure investments to extend broadband connectivity nationally should prioritize the development corridors identified in the recent IBI – USAID Corridor Development Study² (the Development Corridors report), such as from Monrovia to Robertsport and along the railway to be rehabilitated from

² IBI International. “Liberia's vision for accelerating economic growth: A Corridor Development Study,” Final report, prepared and published by the Ministry of Planning and Economic Affairs (MPEA) with Technical Assistance from the United States Agency for International Development (USAID), not dated, circa 2009.

Buchanan to Nimba and on to Guinea.³ These Development Corridors generally connect rural capitals, have the lowest unit cost for construction and will unleash higher concentrations of demand to initiate revenue generation by operators. The following map illustrates these development corridors.

3. **Ensure robust LTA price regulation of cable capacity.** This report supports World Bank recommendations for the development by LTA of a robust enabling regulatory framework to support non-discriminatory access and price regulation to ensure operators pass on reasonably priced ACE access to the broader population. This will require LTA to establish price ceilings or specific prices for wholesale and/or retail provision of internet access. It is recommended that LTA also lay down clear requirements for collocation and infrastructure-sharing in order to reduce unnecessary and duplicative investment by operators in network components, with consequential higher costs to consumers.
4. **Obtain secondary high speed internet connectivity to provide alternatives to ACE.** Additional internet connectivity can be obtained by way of O3b and an upgraded microwave connection to SAT-3 in Ivory Coast. These sources may be able to provide interim international connectivity at a lower cost than VSAT (but with substantially lower capacity than ACE) prior to launch of ACE services in 2012, and provide some competition to ACE services the date at which infrastructure to distribute ACE broadband services will reach some areas of Liberia, and provide competition to ACE services thereafter. Lonestar applied for a license about two years ago for a landing point for the West Africa Cable System⁴ but received no response from the regulator. Lonestar has also considered building a fiber optic cable to San Pedro which has a connection to a landing point for WACS. We are not aware of any substantial progress having been made in relation to either opportunity.
5. **Expedite establishment of Universal Service Fund.** The Telecommunications Act, 2007 (the 2007 Act) provides for the establishment of a universal access fund in Part V. Under the 2007 Act, the LTA may propose and the Minister may approve a policy. GoL recently adopted the ICT Policy which states that a Universal Service Fund shall be established and that licensed telecommunications and ICT service providers shall contribute between 0.5% and 2.0% of their revenues annually to the Fund (in the range of \$250,000 to \$1.0 million assuming total sector revenues of \$50 million). The 2007 Act suggests that LTA should develop a regulation which will deal with the subsidisation of the cost of providing universal access in whole or part, from the Fund.⁵ We understand that LTA views this work as a priority and will commence work on preparing universal access fund regulation in the third quarter of 2010. The goals of each of the 2007 Act and the ICT Policy are to be aligned in relation to universal access and service.

It is recommended that GoL transfer any proceeds from its sale of its investment in CCL (required under its agreement with World Bank) to the Fund and that a major IFI transfer funds to the Fund as set out in detail below. These funds should be applied to subsidize investment in distribution infrastructure, by way of open tender processes for specific broadband access or rollout projects identified and structured by LTA and / or the board of the Fund.

³ Chapter 4 of the Development Corridors Report prioritizes the existing corridor from Monrovia through Margibi and Bong to Nimba. The railway from Buchanan to Nimba is shown as a future corridor as it is being rehabilitated at present.

⁴ West Africa Cable System (WACS) is a 14,000 km submarine cable system with a 3.84 Tbps capacity that runs from Portugal to South Africa with landings in Namibia, Angola, the Democratic Republic of Congo, the Republic of Congo, Cameroon, Nigeria, Togo, Ghana, Côte d'Ivoire, Cape Verde, and the Canary Islands.

⁵ Section 23(1) of the 2007 Act.

6. **Eliminate institutional, regulatory and commercial constraints to private investment in telecom infrastructure.** The GoL has limited funding for infrastructure investment and will need to rely to a large extent on private investment by telecom operators in order to achieve its goal of broad internet access for Liberians. Elimination of institutional, regulatory and commercial impediments to investment is typically one of the methods of obtaining substantial telecom infrastructure investment at the least cost to government. Numerous impediments exist in Liberia which discourage both domestic and foreign investors from investing in telecommunications infrastructure or increase the cost of such investment. Among the most significant impediments is the lack of electricity grid and road system in rural areas. As a result of these impediments rural capitals and other areas have more limited telecommunications service including internet access. Appendix 6 of this report identifies specific impediments to investment in Liberia and recommends measures to eliminate the impediments.

7. **Support Mobile banking and leverage international connectivity by Liberia banks.** Mobile banking or m-banking is rapidly expanding in developing countries across Africa. The ability to transact online in Africa has been taken a step further in the past several years by mobile operators in partnership with major banking institutions to facilitate transfers and payments, balance enquiries and instructions over the phone using device-specific passwords and applications. We recommend that GOL encourage the emergence of viable mobile-money solutions in Liberia by putting enabling legislation in place, supporting operators in negotiating with banks to find mutually acceptable applications and creating awareness of the benefits (detailed in Chapter 8). This will make it possible for citizens to more easily transfer money safely and conveniently to intended beneficiaries, including those living in remote rural areas; provide an improved mechanism for government to make payments and transfers to citizens, such as the civil service payroll and social grants and improve the access of unbanked citizens to financial services. To achieve these goals, GOL should:
 - consider an early pilot of a mobile-money transfer scheme to government employees located in less-remote rural areas. This will help GOL to better understand the benefits and challenges of such systems in the Liberian context, enabling it to learn and adapt the framework, while also signalling to stakeholders its commitment supporting the development of the new services.
 - provide leadership to educate stakeholders, and to achieve a broad-based commitment from all actors to the emergence of the new services
 - Develop a legislative and regulatory environment which conforms to international standards with an appropriate AML/CFT roadmap, to ensure a viable and competitive landscape while safeguarding consumers rights and protections as well as the stability of the financial market
 - Ensure the institutional arrangements are clearly defined so that stakeholders understand and accept their functions
 - Design monitoring systems to improve knowledge of mobile-money transactions, and to provide necessary feedback loops into the regulatory and policy arenas

8. **Implement measures to bridge urban – rural divide.** There is a need for a focused universal access strategy that will address the urban-rural divide. We recommend the development and implementation of a series of **pilot projects** to achieve specific strategic objectives and to be funded by the Universal Service/Access Fund. These projects, ranging from public access centers to critical connectivity to public institutions, will be implemented in rural and under-served or un-served areas only, with special consideration to those areas with high population density (e.g., the North East part of the country) and not reached by the plans to extend the fiber/broadband backbone along the development corridors. However, it will be critical to ensure that some infrastructure is available and that connectivity is a possibility, not just through current and planned infrastructure, but through new

access options such as those provided by O3b or other wireless options provided by operators, such as WiMAX (see Appendix 7 for details).

IMPLEMENTATION ACTION PLAN

The Fast Track Action Plan provides a practical implementation plan to ensure that Liberians, the GoL and Liberian institutions and businesses fully benefit from ACE. The plan has been developed based on input from stakeholders including GoL, ministries, LTA, operators and others, particularly those who will be responsible for taking action. The Action Plan (Appendix 1) includes tasks, roadmaps and timetables and primarily addresses the period from now until 2015. For each task, a responsibility matrix, implementation schedule and measurement parameters are provided.

1 BACKGROUND

The high speed international broadband access provided by ACE will provide only limited benefits to Liberia unless specific steps are taken rapidly to develop distribution infrastructure and prepare Liberians to make full use of this to access broadband services. In essence, there are two phases to ensure that Liberians obtain effective international broadband access:

- Phase I: launch ACE service in Liberia in late 2012 through membership in the ACE consortium and construction of a Monrovia Landing Point for the cable; and
- Phase II: ensure this service reaches a broad range of Liberians across the population at sufficiently low cost to encourage increased take up and thereby facilitate participation by Liberians in the global information society. It will therefore be critical that facilities and infrastructure be in place in Liberia to connect main demand centers to the landing station when ACE services are launched.

The most common reasons why broadband services are not widely used in many countries are that there is no access available quality is poor, the cost is prohibitive, or consumers are not familiar with technology or the internet, and therefore they do not make use of it. The last example is commonly referred to as the “urban-rural” or “digital” divide.

Liberia is no different. High speed broadband access is currently available only to a limited number of Liberians, NGOs, larger businesses, GoL entities and others who obtain international services at very high cost via VSAT service (in the range of \$3,000 to \$7,000 per month per megabit). This Fast Track Action Plan provides a phased Action Implementation Plan to distribute ACE submarine cable capacity which is expected in late 2012 (and capacity from secondary connectivity sources) throughout Liberia and to help eliminate the Urban – Rural (Digital) Divide by (i) eliminating regulatory and commercial impediments to rural internet access; and (ii) preparing rural Liberians to effectively use this access to participate more fully in the Global Information Society.

1.1 BENEFITS OF ICT ACCESS FOR DEVELOPMENT IN LIBERIA

The following chart indicates that every 10% increase in broadband penetration could increase GDP growth in developing countries by 1.38%.⁶ The broadband connectivity provided by ACE will encourage substantially higher broadband penetration in Liberia, thereby increasing broader GDP growth. Research further indicates that the number of households internationally with broadband increased by 18% in 2008, despite the global recession,⁷ so the status quo will not remain static if Liberia fails to increase broadband penetration – and if this happens, Liberia is likely to fall behind its neighbors.

⁶ Source: "Information and Communication for Development Report 2009", World Bank (2009).

⁷ Park Associates, United States.

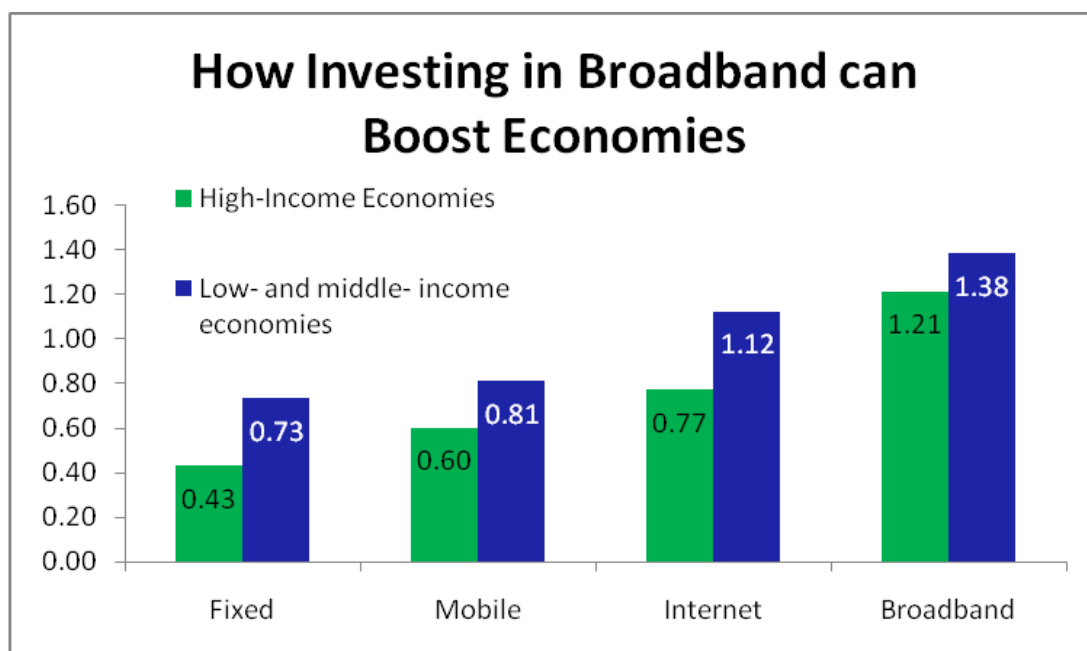


Figure 1. How Investing in Broadband Can Boost Economies

1.2 BROADBAND AND UNIVERSAL ACCESS

In this report we use the phrase “universal access”. The term is defined in the Liberian Telecommunications Act of 2007 (the 2007 Act) as “ensuring the provision of telecommunications services and facilities to residents and other members of the general public in Liberia, in accordance with a universal access policy developed and approved pursuant to section 22”. Appendix 3 examines strategies to extend access to the public internet in rural areas of Liberia, particularly in relation to the distribution of capacity from ACE, in identifying and setting targets in the Action Plan.

In determining targets, the following principles can be adopted:

- Providing and maintaining cost effective access to broadband services in under-served communities and low income subscriber groups without unduly disadvantaging them through higher prices.
- Developing and supporting innovative universal access programs and a clear set of realistic targets and measures.
- Achieving affordable and equitable access to networks enabling internet access, applications and services at community level.
- Mobilising available resources in policy, regulation and funding to provide electronic communications network access to the community.
- Increasing learning opportunities, including the opportunities to acquire and share information.
- Achieving increased access by defined communities in a way that enhances economic inclusion and participation, which may require subsidies
- Providing access for people with disabilities that may include financial assistance for the implementation of specialised equipment and basic facilities for needy users.

Liberia's membership in the ACE consortium as a full landing member authorized to build a Landing Point for the ACE cable in Monrovia through CCL has secured Liberia's access to high speed broadband services access to the public internet. The Government of Liberia (GoL), Liberia Telecommunications Authority (LTA) and operators including Liberia Telecommunications Corporation (Libtelco), Lonestar and Cellcom have demonstrated their commitment to participating in the ACE submarine cable in the following ways:

- **GoL** introduced a new ICT policy and other policy statements supportive of obtaining international connectivity including submarine cable connection (supported by a separate IBI-USAID technical assistance program). These policy measures were based on extensive consultations with operators and other stakeholders, as well as substantial direct investment in CCL made possible by a grant from the World Bank.
- **Liberia Telecommunications Authority (LTA)** provided leadership and support to ACE and CCL negotiations and has committed to introducing an appropriate regulatory regime based on international best practice to support the licensing of CCL and distribution of capacity across Liberia at cost-oriented prices.⁸
- **Liberian operators** committed to make substantial direct investments in CCL and plan to roll out infrastructure to distribute ACE in urban and rural areas of Liberia.

1.3 DEMAND FOR BROADBAND

The size of the broadband market is an essential input for estimating investment requirements to meet market demand and for assessing the potential viability of the investments. Broadband demand is very sensitive to changes in price, with even relatively small reductions in price expected to result in substantial increases in penetration in Africa. As the following chart indicates, an annual decline of only 3% in cost of broadband access in the Africa and Middle East region could help the penetration rate more than quadruple by 2015.

⁸ GoL initiated participation in the ACE submarine cable through the efforts of Libtelco which is a state-owned enterprise. We understand that Liberian operators including Libtelco and LTA signed a Memorandum of Understanding (MoU) with LTA confirming the operators' commitment to hold the Liberian membership in ACE in a company in which they would each hold shares, and committing LTA to the development of a non-discriminatory regulatory framework for cable landing stations and access to and distribution of broadband capacity in Liberia. The Cable Consortium of Liberia (CCL) was formed by Liberian operators to finance, own and manage the Liberian components of the landing point in Monrovia and is the Liberian representative in the ACE consortium. Funding of the landing point will be provided by Cellcom, Lonestar, and the Ministry of Finance through Libtelco.

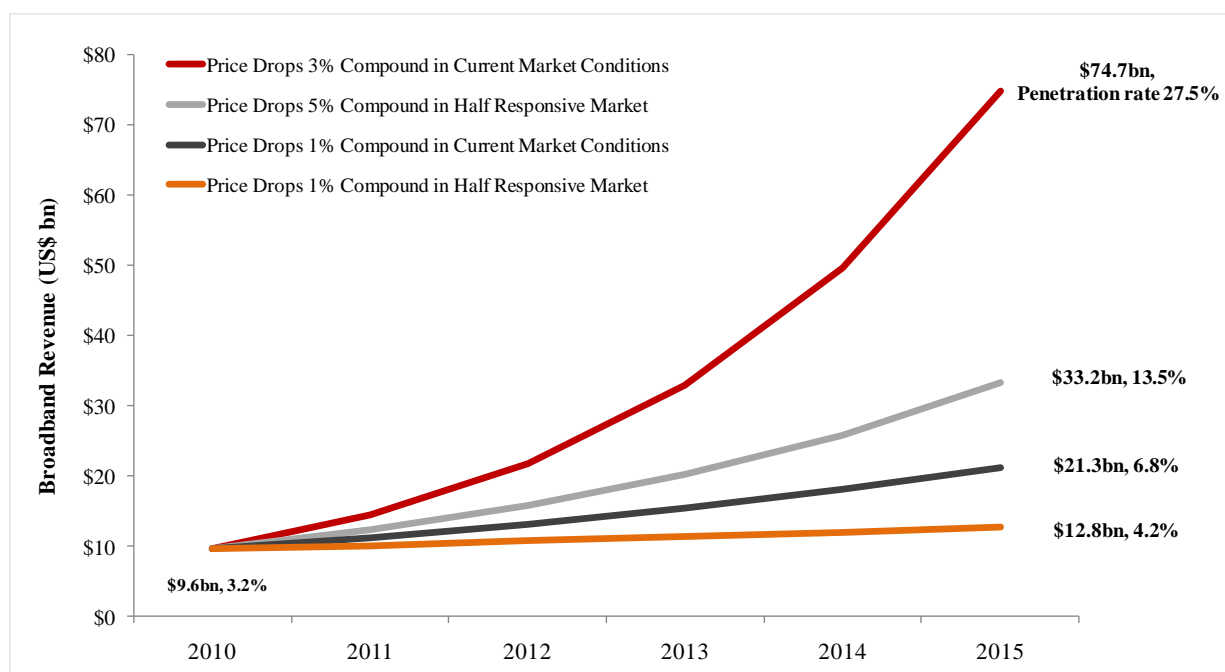


Figure 2. Simulated Broadband Penetration and Revenue Potentials in the Region⁹

The following paragraphs summarize the broadband demand forecast for Liberia that is presented in more detail in Appendix 2. The scope of the services included in the forecast is public internet and IP data services. It should be noted that, over time, given the multi-media nature of IP networks, these IP networks are expected to encompass nearly all communications. Because the network assets under consideration, such as fiber optic cable systems, have economic life spans on the order of 15 to 25 years, the requirements are forecast across 20 years. This forecast forms the basis for developing technology and implementation solutions that under pin the cost estimates. This report focuses on implementation in the first 5 years of these forecasts.

The 20-year forecast to 2030 for broadband customers and customer locations indicates that initially demand for affordable internet access will be strong from mobile internet users, government and business. Over time, residential broadband customer demand is expected to become a significant market segment. Mobile internet access will, of course, continue to grow and should dominate in terms of customer demand. In the long term forecast, mobile internet saturation in Liberia is assumed to occur at about 1 million users, and residential broadband can be expected to be saturated at a few tens of thousands. The number of government and business locations served will each approach about 10,000 locations. By way of comparison, GSM mobile operators currently dominate the communications market in Liberia, with an estimated 1 million mobile users.

Although initially public internet and IP data traffic will be dominated by Montserrado county, which includes Monrovia, in the long term up to 60% of the total traffic will come from the other counties. Across the 20-year forecast period, the total public internet and IP traffic should grow to 60 or 70 Gbps for all of Liberia, including national and international traffic. As may be expected, most traffic will be exchanged with the global internet. International traffic will grow from a small base (today the total

⁹ Pyramid Research, New Undersea Cables Help Boost Africa's Broadband Prospects: The role of African regulators to facilitate market development and ensure affordable prices, presented by Sonia Jorge, Research Director, at the ITU-FTRA, Banjul, The Gambia, July 12-14, 2010.

international capacity from all sources is estimated to be on the order of 100 Mbps), and by 2030 should reach about 50,000 Mbps or 50 Gbps.¹⁰

Long term customer and traffic forecasts are speculative at best. The above forecast was developed from government facility input (schools, medical centers, administrative offices, etc.), formal sector business estimates, current mobile user figures, population distribution data and discussions with Liberian operators. The amount of traffic per user in each market segment will depend to a large degree on video take-up over the internet for both conferencing and entertainment. Current indications (including based on discussions with Liberian operators) are that this take up will be strong, but the economics of content generation, regulation, and technology will all impact growth in demand. The forecast is believed to be conservative and growth may, in fact, be higher. Of course, demand will be strongly affected by pricing and the overall economic conditions that prevail across time.

The demand methodology applied in our study was necessarily high level and conceptual, which is acceptable for strategic planning studies. The demand forecast was used in our subsequent analysis to prepare reference designs against and to estimate costs and potential revenues. Since the forecast has fairly wide error margins, the results of downstream analysis are only indicative. The results are, however, adequate to enable planners to make informed strategic and directional decisions. Prior to committing investment, subsequent planning with improved resolution should be completed to confirm feasibility of specific projects within the overall strategic framework.

¹⁰ Please see underlying assumptions or 50 Gbps estimated demand in 2030. Summary of assumptions: approximately 45 Gbps of demand in 2030 is from residential broadband. The model assumes that in 2030 there are 30,000 residential broadband subscribers, which is 5% penetration (from a conservative assumption that the population shrinks to 3 million and the average household is 5 people per the 2008 census). This is equivalent to ~1.5 Mbps of usage per broadband subscriber. This would occur if half the subscribers were watching one standard definition TV show at the same time (at 3-4 Mbps typical) or half of that again if they were streaming one high definition channel (current predictions are that advances in HDTV compression will improve from today's 16 Mbps to reach 8 Mbps).

2 OPTIONS TO DISTRIBUTE BROADBAND CAPACITY IN LIBERIA

The capacity that can be provided to Liberia by the ACE cable is able to provide low cost and reasonable quality access at, possibly, a cost of several hundred dollars per megabit per second month¹¹. This cost includes the annual maintenance and “capital repayment” for ACE, and compares favourably to current costs in Liberia for VSAT service of \$3,000-7,000 per month.

Consistent with the scope of the demand forecast in the Situation Analysis (Appendix 2), the scope of the technical solutions in this appendix includes public internet and private IP network traffic. Existing voice and mobile traffic is not directly considered; however in the longer term, this traffic is indirectly included because internet and IP traffic can be expected to dominate and the facilities for this traffic will be able to accommodate the existing voice mobile traffic and its expected growth. The high capital cost of network infrastructure and ongoing operations necessitates, for affordability reasons, a long cost recovery period. Therefore a long term strategic level development plan is needed.

In general terms, the strategy involves an examination of design, implementation, and funding alternatives. The overall strategy is financially and economically justified based on a high level and preliminary analysis. This approach provides a broad strategic program-level basis for action. As applicable, planning each project within the program will require preparation of preliminary and detailed feasibility studies that incorporate a business case.

Although ACE capacity will meet much of the need by Liberia for low cost high speed international access, additional secondary connectivity sources are needed for the following reasons:

- ACE service will be launched by late 2012, so interim solutions would be helpful to replace expensive VSAT service prior to 2012 which can also compete effectively with ACE after launch;
- effective secure internet access requires redundancy, in case one source of connectivity fails;
- other options such as O3b will provide less expensive access in some rural areas for reasons of geography or need; and
- to assist GoL in meeting its internal security requirements.

This workstream evaluated various options to obtain secondary connectivity for ACE. The following table summarizes the findings. From the table, it is reasonable to conclude that terrestrial microwave to the frontier (e.g., with Cote d’Ivoire) and/or O3b could be an interim solution, and in the long term, terrestrial fiber to the frontier and/or a second cable landing would be preferred.

¹¹ Assuming an all up cost of \$29.2 million for the ACE landing (includes the contribution to the ACE consortium and related in-country costs at the landing station, plus contingency), 15 year system life, 14% discount rate, \$1.8 for annual maintenance fees, and 5292 Mbps capacity (from 42 STM-1 each with 63 E1 effective packet data capacity), the annual revenue requirement per Mbps is ~\$1,240, or ~\$105 per month. If capacity fill is approximated by linear growth from zero to full, then the average revenue requirement would be ~\$210 per month per Mbps. The connectivity program model developed for this study assumed that ACE capacity would be upgraded during its life at a lower unit cost than the original build. This model used a sliding price scale that started at \$700 per Mbps per month and decreased as demand and traffic increased until, at the end of the study period (2030), \$50 per Mbps per month was assumed. This is the price charged by CCL and does not include mark up nor provisions for cost recovery of domestic facilities (i.e., this is not the end customer price). See Appendixes 2, 3 and 4 for further background, assumptions, and details.

Figure 3. Evaluation of Secondary Connectivity Sources

Evaluation of Secondary Sources of Connectivity for Liberia to Provide Redundancy for ACE			
Technology	Advantages	Disadvantages	Comments
O3b	<ul style="list-style-type: none"> + Relatively low capital costs. + Moderate recurring cost for capacity on a per Mbps basis. + Can provide capacity from county capital to Monrovia as well as to the global internet. Estimated by African Development Bank Group to cost in range of \$700/MB/second/month. 	<ul style="list-style-type: none"> - At least a full transponder of capacity is required for a national beam; which is relatively expensive; especially if it cannot all be used. - Not available until 2012 or 2013. - Ka band is subject to rain induced impairments. - Higher ongoing cost than ACE 	Useful to provide connectivity in rural capitals and district and clan level
Overland access via Upgraded Microwave SAT-3 in Ivory Coast	<ul style="list-style-type: none"> + Useful for rapid extension of moderate amounts of capacity if existing systems can be economically upgraded or overbuilt. + Useful for interim backup and for distribution of capacity out from county capitals. 	<ul style="list-style-type: none"> - Insufficient capacity for long-term backbone. - Lack of substantial capacity on SAT-3 and lack of control Liberian over that capacity 	Care should be taken not to “over-invest” in microwave facilities when the long term solution is fiber optic cable.
Overland access via Fiber Optic to SAT-3 in Ivory Coast	<ul style="list-style-type: none"> + Low recurring cost per megabit per second for high-capacity routes. + The fiber-optic cable has a long useful life (15 to 25 years). + Very high capacity. 	<ul style="list-style-type: none"> - High capital costs. - Back up link required for reliability. - lack of substantial capacity on SAT-3 	
Legacy VSAT service (to be phased out)	<ul style="list-style-type: none"> + Low capital costs. + Useful for interim backup. 	<ul style="list-style-type: none"> - High recurring cost for capacity. - Ku band is subject to rain induced impairments. 	

Accordingly Chapters 3 and 4 and Appendices 3, 4 and 7 consider the various options along these lines. The Appendices contain the underlying detail and assumptions.

3 INFRASTRUCTURE TO DISTRIBUTE INTERNET ACCESS IN LIBERIA

This report identifies three components to roll out infrastructure to distribute high capacity internet access across Liberia, which are set out here in order of priority:

1. **Monrovia:** Approximately 40-50% of the total demand for internet access in Liberia is expected to be in Monrovia. The cost to build out distribution infrastructure in the capital is estimated to be up to \$20 million (depending on the extent of the network, technology deployed, contract scope, and funding source) and is expected to be built out in phases primarily by Libtelco complemented by other operators.

Based on the analysis in this report and discussions with Liberian operators, we conclude that virtually all of this infrastructure will be provided on a commercial basis by private operators and Libtelco, through a combination of fiber optic cable infrastructure, upgrades to mobile operators' microwave facilities, upgraded mobile infrastructure (3rd or 4th generation), and new WiMAX infrastructure where applicable. Libtelco has already announced that it has engaged ZTE to construct a limited fiber optic network in Monrovia to connect key government ministries and university campuses, financed by the Ministry of Finance using approximately \$380,000 in funding from a World Bank programme.¹² This will provide basic infrastructure which Libtelco can then use to connect NGO's, businesses and residential users.

2. **Connect Rural County Capitals to Monrovia:** Most large operators already have microwave connections to most rural capitals. For example, Lonestar has microwave links to all rural county capitals except Grand Kru; it is expected that it will upgrade these microwave links as an initial step to support broadband but will quickly require fiber optic link in order to distribute reasonable amounts of capacity at reasonable prices. Given Liberia's small geographic area, the cost of installing additional towers is reasonable as an interim solution prior to full fiber optic cable links to county capitals. Lonestar intends to start rolling out WiMAX in Monrovia in summer 2010 and will later move beyond Monrovia. The cost of connecting the 14 county capitals to Monrovia by fiber optic cable is substantial, estimated in the range of \$60 million to \$120 million. While costly to build, the cost per unit of capacity provided is very low, particularly in light of the 20-30 year lifespan of fiber optic cable.

The economic and social benefits of these links are nonetheless substantial: support for decentralization of cadastre system to rural county capitals (already in process), reporting by health facilities and government offices in rural areas will be expedited, access by county residents to government services will be facilitated, business information on markets will be obtained more rapidly, families will be able to contact other family members attending school in Monrovia or abroad. Given the population, business and institutional density in these rural capitals and the location of many of the rural capitals within identified Development Corridors, the connection of these centers to internet access is a natural priority. Connecting Liberia's rural county capitals to ACE internet access is therefore the focus of this Report's infrastructure development proposals.

¹² The Ministry of Finance has agreed to pay ZTE's cost of \$380,000 to connect the six ministries (\$55,000 for each of six nodes) although the other costs associated with the project will need to be funded by Libtelco through other sources. In return, the ministries will obtain free use of the fiber optic network for 5 years and free use of a data facility at Libtelco's Sinkor branch for 3 years. Libtelco has also agreed to a donation by University of Indiana of used fiber optic cable which will be used to link University of Liberia. The university will obtain free use of the network for 3 year years.

3. **Connecting Rural Areas at the District and Clan Level:** Despite demand being largely Monrovia-based, approximately 53%¹³ of Liberia's population in fact lives outside Monrovia and rural county capitals, and is located in small villages and other rural communities. These villagers travel to rural capitals to conduct business and interact with government. We estimate the cost of building the infrastructure required to connect these remaining areas to ACE cable access at approximately \$100 million to \$200 million.

Given the high cost of these links, the need to first develop the national backbone to rural capitals before rural villages can be connected to it, and the need to develop a basic ICT literacy among these residents before they can benefit to a meaningful degree from internet access, this report recommends that measures in these rural areas in the next 5 years focus on developing ICT awareness and capacity to use internet rather than construction of broadband infrastructure itself. After rural capitals have all been connected and rural communities have a better appreciation of how they can benefit from ICT and therefore more need for it, further infrastructure could be rolled out to these areas.

In compiling this section we have taken account of the MPEA Development Corridor study conducted by IBI for USAID in 2010. The Development Corridor study recommends a development strategy that focuses investments into logical corridors where diverse activities can share basic infrastructure including roads, rail lines, power, ports, water, and telecommunications. These extend out from Monrovia along the paved roads and the Bong railway. Feeder corridors to the Monrovia-Nimba corridor include a feeder to the north-west (picking up Voinjama and Foya) and a feeder to the south-east (picking up Zwedru, Greenville, and Harper). Mining projects expected to start under the next six years should and extend corridors: (i) Buchanan to Nimba, (ii) Monrovia to Mano River via Bomi Hills and Bea Mountain, and (iii) Greenville to the Putu Range. Power, road, and railway infrastructure is of particular interest because these rights-of-way can be economically exploited for fiber-optic cable routes. If cable construction can be coordinated with power transmission line construction or road construction, then cable placement cost is minimal. These rights-of-way can also be used to improve internet reliability and security through route diversity.

3.1 RECOMMENDATIONS

GoL should connect rural county capitals first: To achieve the greatest benefit from a national plan to roll out internet distribution, we recommend that GoL focus its efforts on development of the infrastructure needed to distribute internet access by connecting rural county capitals, because:

- Monrovia infrastructure can be expected to be funded primarily on a private commercial basis;
- fiber optic links between Monrovia and capitals will be needed as starting point for rural access networks; and
- extending connectivity to rural district and clan populations will remain uneconomic and of minimal value to residents for some time.

¹³ Chapter 2, Table 2-2.

The following design illustrates the routing concept for the county capital fiber optic backbone network:

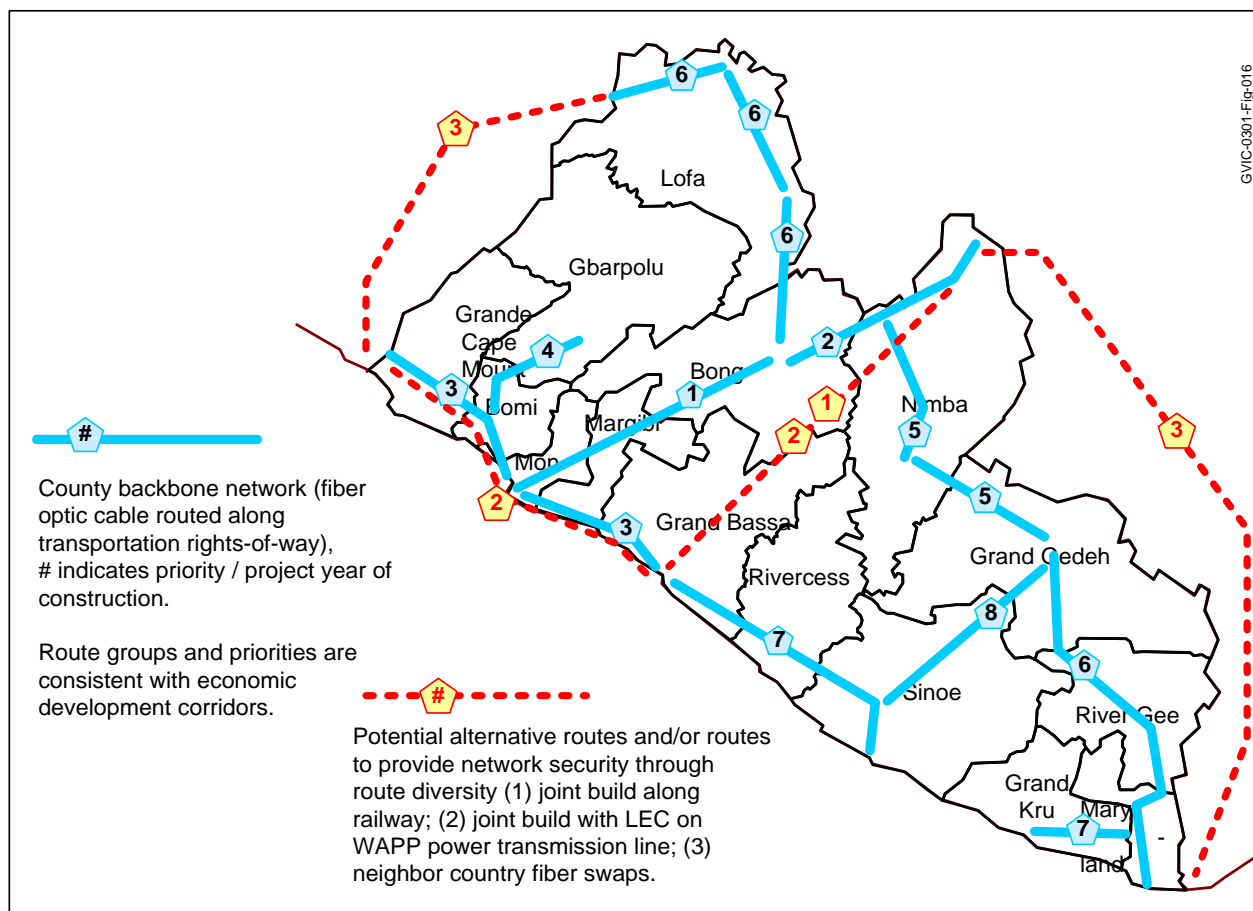


Figure 4. Routing Concept for the County Capital Backbone Network

Focus Infrastructure Along Liberian Development Corridors: As noted above, this report recommends that infrastructure roll out be prioritized along identified Development Corridors in order to maximize economic and social multiplier impact on the broader Liberian market. Figure 5 is a map showing the existing 5 corridors where economic activity is concentrated.

The following map illustrates the corridors:

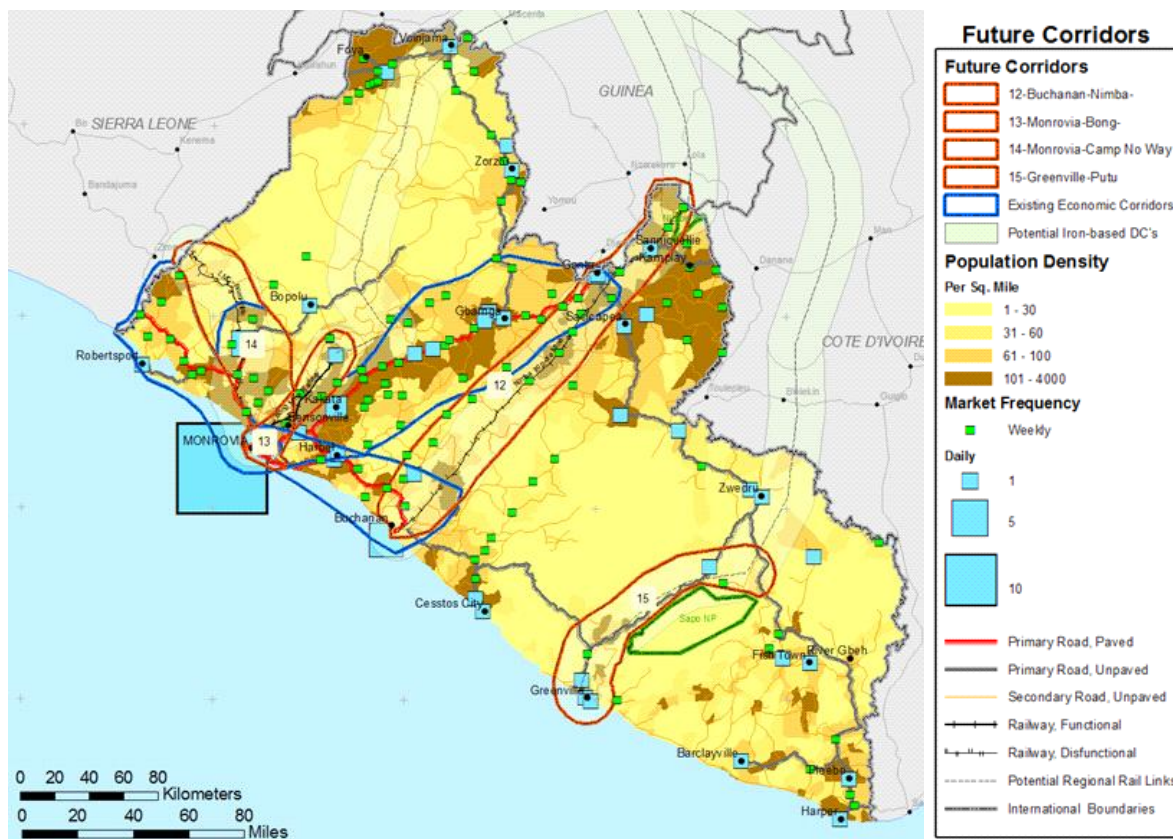


Figure 5. Economic Corridors in Liberia. Source, Map 1C

The following figure illustrates the routing plan for a county backbone fibre optic network:

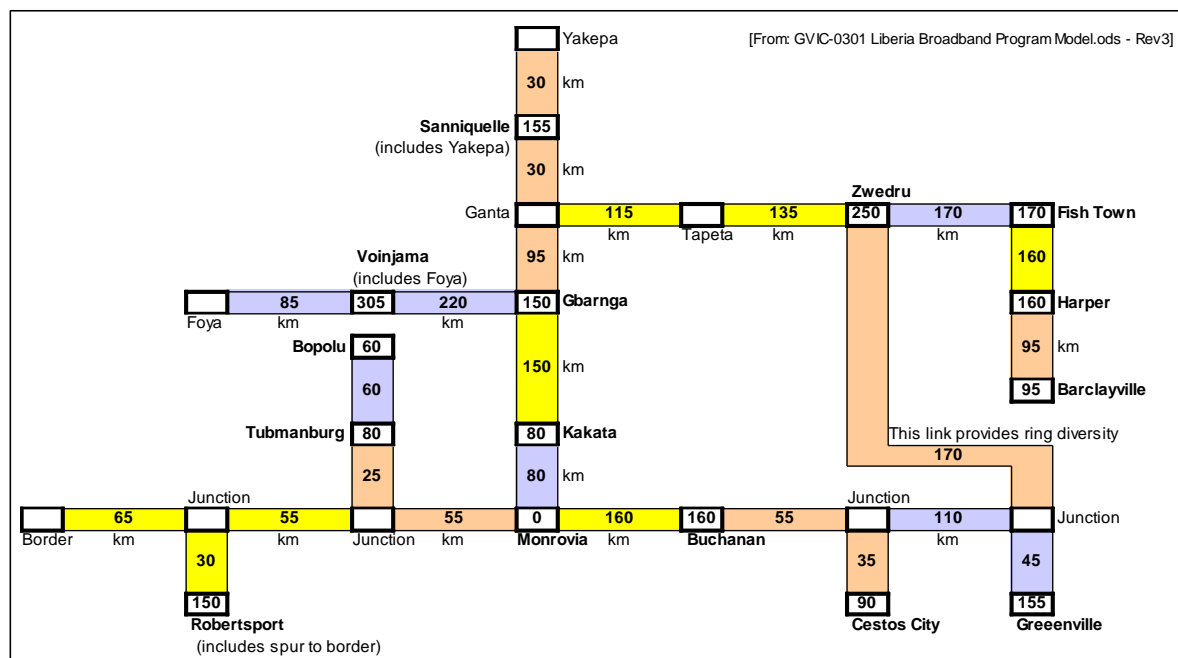


Figure 6. Routing Plan for County Backbone Fiber Optic Network (Provisional Reference Design)

The route kilometer estimates are based on manual measurements from a 1:600,000 scale road map with a 20% margin added to compensate for scale and measurement simplification related errors. A Yakepa-Buchanan link is also possible as a joint construction with the LEC WAPP high voltage transmission line or alternately along the mine concession rail line.

Finally in the two figures below we have produced a concept diagram for rural access network architecture, county capital to district headquarters extension, and a concept diagram for rural access network architecture, district headquarter to clan headquarter extension:

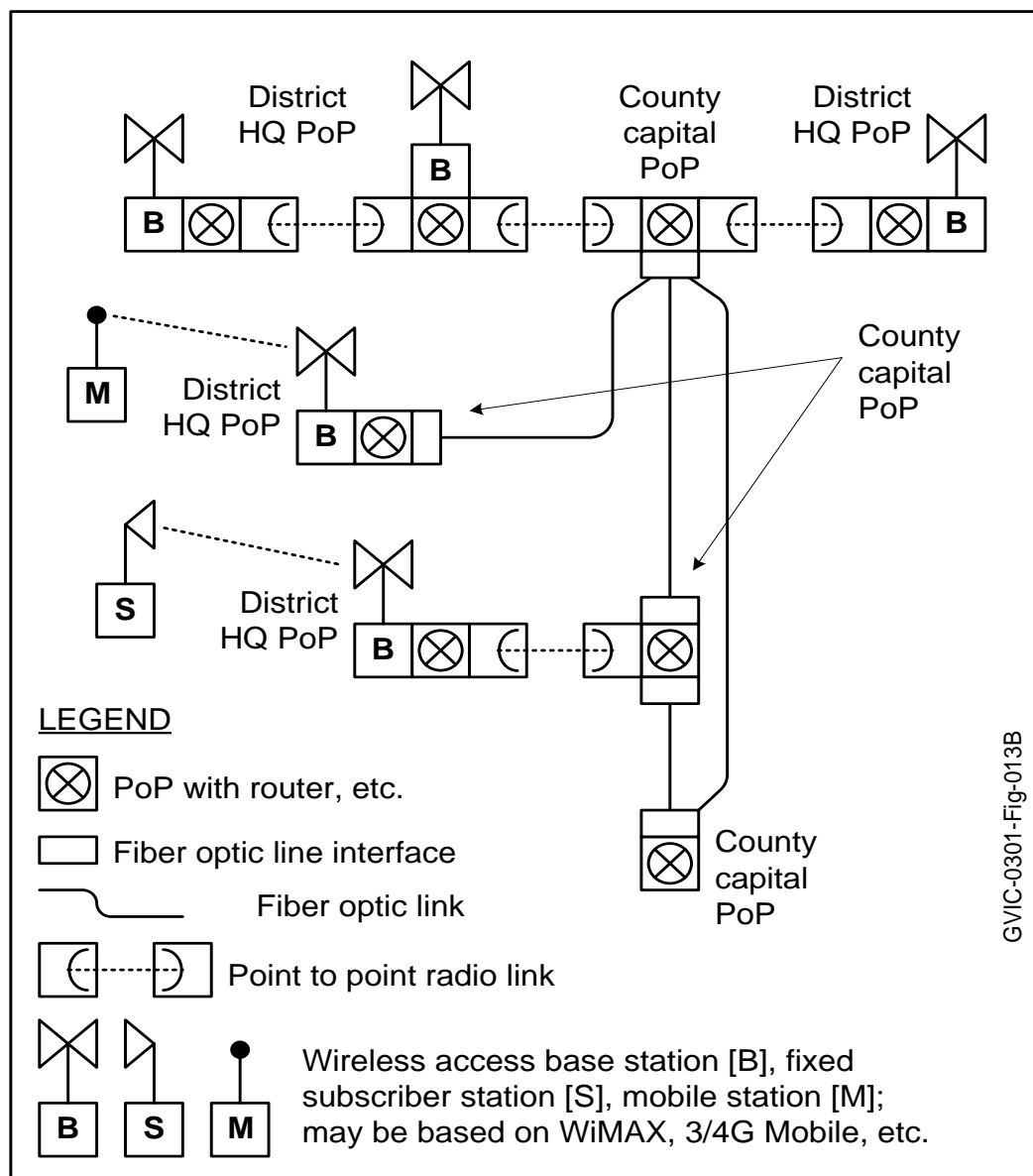


Figure 7. Concept Diagram for Rural Access Network Architecture, County Capital to District Headquarter Extension

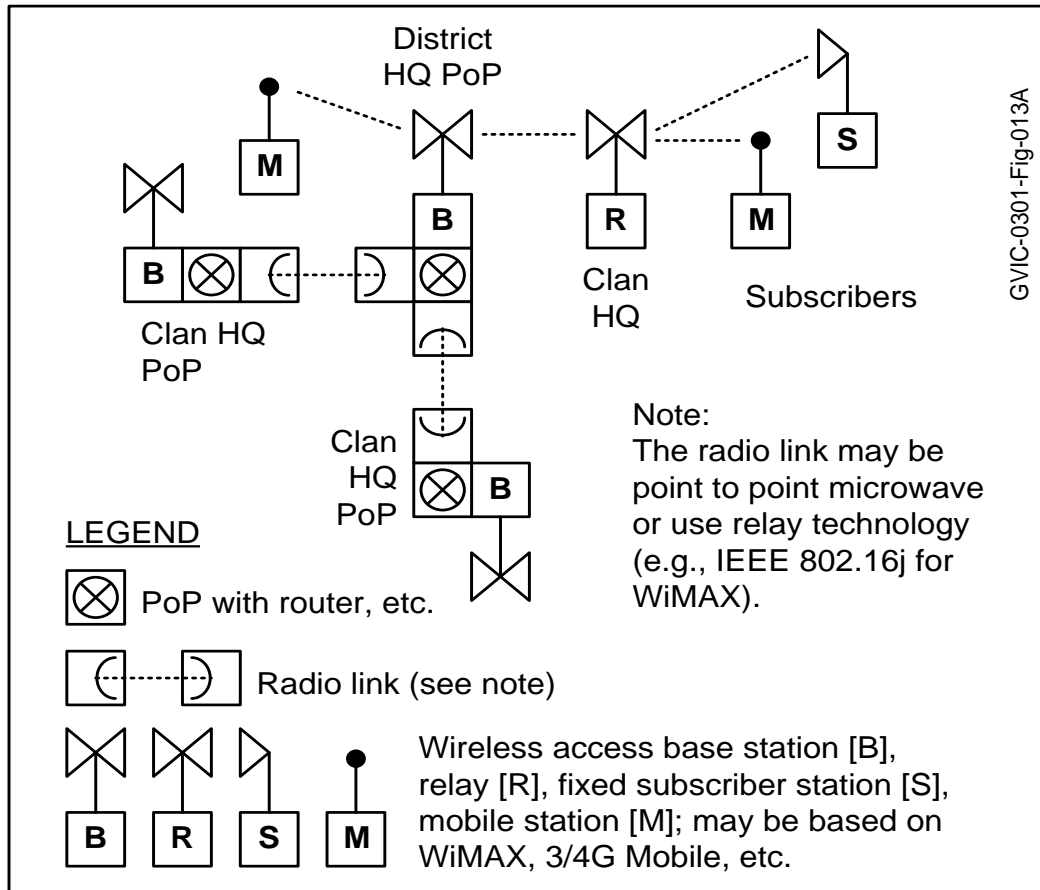


Figure 8. Concept Diagram for Rural Access Network Architecture, District Headquarter to Clan Headquarter Extension

4 COSTS FOR INFRASTRUCTURE ROLL-OUT

The cost of rolling out distribution networks in the 3 key areas outlined in Chapter 3 is described in this table:

Figure 9. Key Areas for Distribution Networks		
Area	Estimated Cost	Type of Infrastructure Required
Greater Monrovia including Roberts Airport	Up to \$20 million	Fiber optic cable ring, microwave links, 3 rd or 4 th generation Mobile infrastructure, WiMAX
Connection to Rural County Capitals	\$60 to \$120 million	Primarily fiber optic cable, also microwave links
Rural Areas – District and Clan Level	\$100 to \$200 million	Wireless access technology such as 3G and 4G cellular mobile and/or WiMAX

To estimate costs and establish the potential for viability, a reference design was developed to extend broadband connectivity across Liberia. Consistent with the scope of the demand forecast noted earlier, the scope of the technical solutions in the reference design included public internet and private IP network traffic. Existing voice and mobile traffic was not directly considered; however in the longer term, this traffic is indirectly included because internet and IP traffic can be expected to dominate and the facilities for this traffic will be able to accommodate the existing voice mobile traffic and its expected growth. The high capital cost of network infrastructure and ongoing operations necessitates, for affordability reasons, a long cost recovery period. Therefore a long term strategic level development plan is needed.

This section summarizes a strategic level development plan that is described in further detail in the technical strategy in Appendix 4. In general terms, an overall program was developed to meet the demand forecast for public internet and IP data traffic based on an examination of design, implementation, and funding alternatives. The overall program was financially and economically justified based on a high level and preliminary analysis. This provides a broad strategic program-level basis for action. The planning of each project within the program will require preparation of preliminary and detailed feasibility studies that incorporate a business case. Key findings from Appendix 4, including investment requirements, are summarized below.

It should be noted that the following cost items are NOT included in the business model set out in this Chapter read with Appendix 4:

- license fees including for offering services, operating networks, or spectrum;
- customs and import duty;
- building permits;
- value-added or general sales tax; and
- unofficial taxes or illegal payments and bribes.

Further, land acquisition and right of way acquisition costs have been assumed to be minimal. If applicable, these cost items add to the initial capital cost and can be factored in by applying a multiplier to the capital cost estimates.

The ACE submarine cable landing is estimated to cost approximately \$29 million initially, including the contributions to be made to the ACE consortium and related in-country costs at the landing station, plus contingency amounts.

In late 2012, when the landing station in Monrovia is commissioned, Liberia will be connected to the global internet with approximately 5.3 gigabits per second (Gbps) of fiber optic broadband capacity (e.g., to a Tier-1 internet backbone provider in Europe). In the near term, some of this connectivity can be distributed across Liberia by exploiting existing microwave facilities. In the longer term, a national fiber-optic network to each of the county capitals outside of Monrovia will be required. From these capitals, connectivity can later be distributed out to the rural district and clan headquarters using standards-based wireless access technology such as 3G and 4G cellular mobile and/or WiMAX.

The following table illustrates the costs and capacity estimates for ACE:

#	Parameter (units)	Note	Value
1.0	General		
1.1	Initial capacity (Gbps)	N1	5.3
1.2	Capacity increment size (Gbps)		5.3
2.0	Capital cost estimate (\$M)	U/C Qty	Total
2.1	ACE capital cost contribution	25 1	25
2.2	Associated non-ACE costs	2 1	2
2.3	Internet exchange point (IPX)	0.2 1	0.2
2.4	Project contingency	2 1	2
2.5	Expansion cost per 5.3 Gbps	5 TBD	
2.0	Operating cost estimate	U/C Qty	Total
2.1	Annual amount, based on % of capital (\$M)	1.8 1	1.8
2.2	Percent of capital to use for above estimate	6%	
Notes:			
N1 Assumes 42 STM-1 with 63 E1 each (42x63x2Mbps=~5.3 Gbps).			

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 10. African Coast to Europe (ACE) Submarine Cable System, Capacity Parameters and Budgetary Cost Estimate. (U/C=Unit Cost in USD; and Qty=Quantity)

The initial connection from the Liberia landing point in Monrovia to operator networks is expected to be funded by the operators themselves without GoL subsidies or support. These investments are minimal and the availability of high performance international connectivity that some operators will have already invested in will, in our view, provide sufficient incentive to construct these terrestrial tail facilities.

The national fiber-optic network to the county capitals will require \$60 to \$120 million capital investment to fully deploy. The district and clan level access networks will require an additional capital investment of approximately \$100 to \$200 million. These are significant amounts and must be spread out over a 10 to 15 year period for economical cost recovery. Investment for distributing connectivity within the urban concentrations of Monrovia and to the county capitals is expected to be provided on a commercial basis by competing service providers (e.g., existing fixed and mobile operators, internet service providers, etc.) and has not been included in the business case analysis of this current study. It should be noted that, although these amounts are not estimated here, they will require substantial operator investments on a commercial basis.

The estimated total traffic demand forecast (national and international) by County is represented below in Mbps including capital, districts and clans:

County	2016	2020
Bomi	141	811
Bong	501	3,214
Gbarpoku	118	692
Grand Bassa	331	2,047
Grand Cape Mount	174	1,041
Grand Gedeh	194	1,239
Grand Kru	110	523
Lofa	388	2,563
Margibi	344	2,282
Maryland	205	1,351
Montserrado	2,174	14,822
Nimba	643	3,994
River Gee	116	645
Rivercess	104	570
Sinoe	167	898
This forecast assumes the availability of good quality and affordable internet access.		

Figure 11. Total Demand Forecast

The national fiber-optic network to the county capitals and rural access networks can be implemented in phases to reduce the annual investments, and enable the more economically active and financially viable areas to be connected first. The full nationwide fiber-optic network to the county capitals may take up to 10 years to build; and rural access networks at the district and clan level will start later and require longer.

The baseline construction program developed during this study requires a total of approximately \$85 million in capital investment between now and 2018. Specific phases can be defined and budgets estimated as investment funding becomes available and as a business model or construction authority is identified. In the near term, the existing mobile operators currently

own and operate microwave systems that can be further exploited and upgraded by these operators. Also, as noted earlier, there is an existing high quality microwave route and network operated by UNMIL that uses existing operator radio sites and facilities to link Monrovia to the SAT-3 submarine cable landing in Côte d'Ivoire. This asset could form the initial nucleus of a terrestrial open-access national network.

To enable rapid network extension to all county capitals ahead of the fiber-optic network, at significantly less capital expense than fiber optic cable or upgraded microwave links, we have assessed participation in the O3b satellite network. An estimated investment of \$6 to \$10 million would provide O3b connectivity to network points of presence in each of the county capitals by 2013 (assuming O3b launches on schedule). O3b can also provide redundancy and security for the submarine cable as alternative sources and routes of international connectivity are implemented (such as fiber-based cross border connections to SAT-3, additional cable landing points, etc.) The following table illustrates the indicative unit costs for an O3b satellite-based network to the county capitals:

#	Parameter (units)	Value
1.0	Tier-1 IP Trunk Terminal, Monrovia	
1.1	O3b capital expenditures (\$K)	300
1.2	Support facility capital expenditures (\$K)	200
1.3	Estimated power consumption (kW)	10
2.0	Remote Terminal, each county capital site	
2.1	O3b capital expenditures (\$K)	35
2.2	Support facility capital expenditures (\$K)	65
2.3	Estimated power consumption (kW)	2
3.0	Annual operating expenditures	
3.1	O3b space segment, transponder and beam (\$K)	4,500
3.2	Central site maintenance, Monrovia (\$K)	25
3.3	Remote site maintenance, each capital (\$K)	5
3.4	Central site power, Monrovia (\$K)	43.8
3.5	Remote site power, each capital (\$K)	8.8
4.0	Assumptions	
4.1	Annual maintenance cost as a % of capital (%)	5%
4.2	Maximum O3b downlink capacity (Mbps)	290

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Please refer to Appendix 4 (Technical Strategy) for an overview of the proposed long term network architecture and fiber optic network route diagram that shows the network building out along the transportation and development routes. In addition, this Appendix provides a phased implementation schedule for the program, and a diagram to illustrate the overall business model, with individual business units for international facilities (CCL), the county backbone network (CBN), and the rural access network (RAN).

Figure 12. Indicative Unit Costs for an O3b Satellite Based Network to the County Capitals

A potentially important early component of the fiber optic backbone is expected to be a fiber optic cable which may be laid along the existing railway line from Buchanan to Nimba county when the line is being rehabilitated under a Concession Agreement by an international mining and steel company. The line is expected to all be used by other mining and timber companies active in Liberia, Sierra Leone and to transport ore and other resources in future. An alternative that would provide fiber along this same route as well as from Buchanan to Monrovia and on to Sierra Leone would be to combine fiber with the shield ground wire on the proposed West Africa Power Pool (WAPP) transmission line that will extend through Liberia from Ivory Coast. These alternatives have the potential to significantly reduce backbone construction costs on these routes (the WAPP line may be particularly attractive). These savings and routes have not been included in the cost estimates and, until more specific plans are known, should be viewed as possible high priority projects to actively explore.

A preliminary assessment of the connectivity program indicates that, while the overall program is estimated to be financially and economically viable, not all individual components are viable on their own without subsidies. Specifically, the overall program exhibits a baseline financial internal rate of return of about 15% and economic internal rate of return of 28%; whereas the financial internal rate of return for the CCL, CBN, and Radio Access Network are 30%, 4%, and -2%, respectively. These results, although preliminary, are relatively robust across a range of likely input assumption variations.

The following diagram contains a preliminary construction schedule for Liberia broadband connectivity program (which forms the basis for financial analysis model):

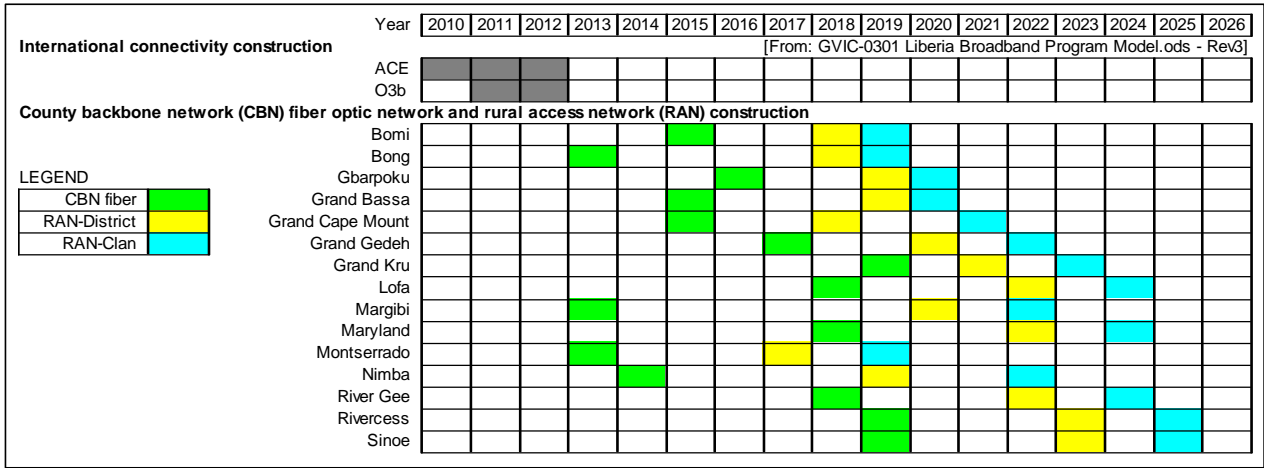


Figure 13. Preliminary Construction Schedule for Broadband Infrastructure

A preliminary review of the different ownership and business approaches concluded that (i) a private public partnership, similar to CCL (and possibly led by CCL acting as the vehicle for future Internet capacity distribution projects), may be an optimal model for the CBN, and (ii) tendering components of the CBN and the Radio Access Network to the private sector on a minimum subsidy basis may be optimal for the rural service extensions (by region or nation-wide)¹⁴. The following figure indicates in simplified terms, a view of the overall business model, showing distinct business entities for open access international network, open access national fiber backbone (to county capitals), and rural access networks (to district and clan headquarter levels).

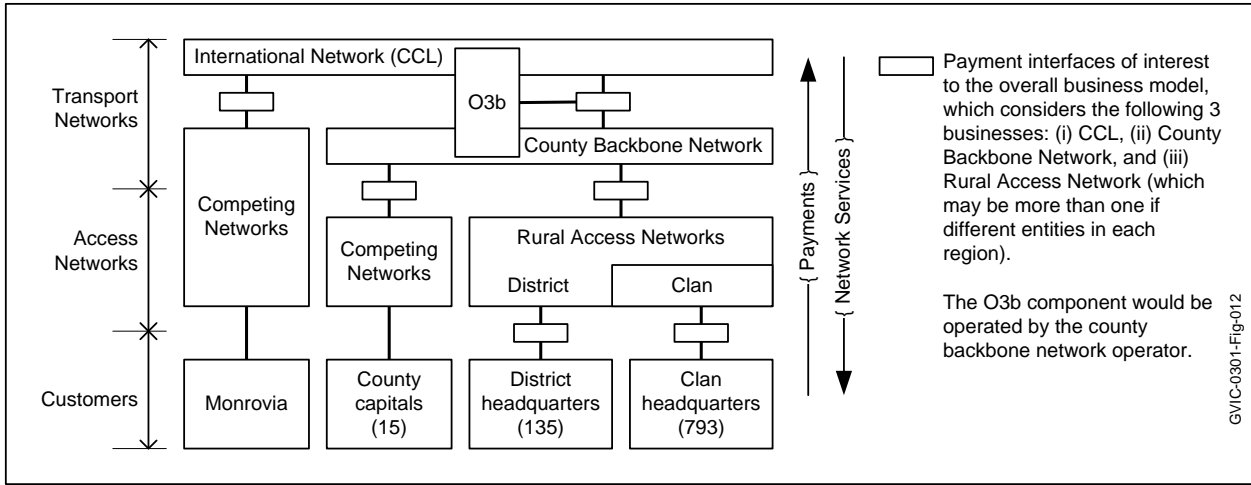


Figure 14. A Simplified View of the Overall Business Model

A preliminary risk assessment identified the usual risks of: (i) construction delays and cost overruns for the networks (including O3b), (ii) lack of demand due to general economic failure or a lack of economic recovery, and (iii) inappropriate business models and/or an ineffective regulatory regime. The fiber optic

¹⁴ The Telecommunications Act 2007 and National ICT Policy 2010 mandate the establishment of a Universal Access Fund, which is expected to be founded via new regulations developed by LTA on an expedited basis.

cable route construction cost estimates in this planning document are particularly vulnerable to error as they have been made without access to formal route planning, preliminary route surveys, nor local information on the river crossings required. An important risk mitigation strategy may be to encourage the mobile operators in the near term to exploit and upgrade their existing microwave systems and thereby begin opening the rural county internet markets.

The following table illustrates the indicative unit costs for a fiber optic network to the county capitals:

#	Parameter (units)	Value
1.0	Fiber optic cable routes	
1.1	Capital cost, installed, normal (\$K per km)	25
1.2	Capital cost, installed, difficult (\$K per km)	35
1.3	Annual cable maintenance cost as % of capital	2.5%
2.0	Fiber optic cable - line termination allowance	
2.1	Capital cost for interfaces (\$K per 100 Mbps)	10
2.2	Annual interface maintenance cost as % of capital	10%
3.0	County point of presence (PoP), each PoP	
3.1	Capital cost for equipment, installed (\$K)	75
3.2	Capital cost for support facilities (\$K)	225
3.3	Power consumption (kW)	5
3.4	Annual maintenance cost as % of capital	5%
3.5	Annual cost for power (\$K)	21.9

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 15. Indicative Unit Costs for a Fiber Optic Network to the County Capitals

We indicate in figure below the rough order of magnitude base construction cost estimates for the county broadband network (where U/C=unit cost in USD; and Qty=quantity):

#	Parameter (units)	U/C	Qty	Total
1.0	O3b satellite system			
1.1	Tier-1 IP Trunk Terminal site (\$K)	500	1	500
1.2	Remote Terminal site (\$K)	100	14	1,400
2.0	County PoP	300	14	4,200
3.0	Fiber optic network (\$K)			
	Margibi, Kakata	25	80	2,000
	Bong, Gbarnga	25	150	3,750
	Nimba, Sanniquelle	25	155	3,875
	Bomi, Tubmanburg	25	80	2,000
	Grand Cape Mount, Robertsport	25	150	3,750
	Gbarpoku, Bopolu	35	60	2,100
	Grand Bassa, Buchanan	25	160	4,000
	Lofa, Voinjama	25	305	7,625
	Grand Gedeh, Zwedru	35	250	8,750
	River Gee, Fish Town	35	170	5,950
	Maryland, Harper	35	160	5,600
	Grand Kru, Barclayville	35	95	3,325
	Rivercess, Cestos City	35	90	3,150
	Sinoe, Greenville	35	155	5,425
4.0	Interfaces, link pair per 100 Mbps (\$K)	10	TBD	
Grand total (without project overhead and contingency)				67,400
Note: The number of interface units (optical line drivers) is a function of the required capacity which varies by year and location.				

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 16. Rough Order of Magnitude Base Construction Costs: A County Broadband Network

The figure below sets out rough order of magnitude for rural access network assembly costs for district and clan level extensions (where U/C=unit cost in USD; and Qty=quantity):

#	Parameter (units)	U/C	Qty	Total
1.00	Base construction cost per District HQ			232.0
1.01	Licensed band, hot standby, 50 Mbps (\$K)	100	0.5	50.0
1.02	Licensed band, hot standby, 100 Mbps (\$K)	120	0.5	60.0
1.03	Base station, 2-branch diversity, 3 sectors (\$K)	76	1	76.0
1.04	Additional PoP infrastructure	10	1	10.0
1.05	Allowance for tower	25	1	25.0
1.06	Allowance for power	5	1	5.0
1.07	Allowance for equipment shelter	5	1	5.0
1.08	Allowance for land / right of way	1	1	1.0
2.00	Base construction cost per Clan HQ			120.5
2.01	License exempt, non-protected, 50 Mbps (\$K)	40	0.5	20.0
2.02	License exempt, non-protected, 100 Mbps (\$K)	50	0.2	10.0
2.03	Licensed band, hot standby, 50 Mbps (\$K)	100	0.1	10.0
2.04	Licensed band, hot standby, 100 Mbps (\$K)	120	0.05	6.0
2.05	Base station, 2-branch diversity, 3 sectors (\$K)	76	0.1	7.6
2.06	Base station, 1 sector no, diversity (\$K)	24	0.75	18.0
2.07	Relay station, 1 sectors (\$K) [N2]	36	0.15	5.4
2.08	Router, provider edge	10	1	10.0
2.09	PoP infrastructure allowance	8	1	8.0
2.10	Allowance for tower	20	1	20.0
2.11	Allowance for power	3	1	3.0
2.12	Allowance for equipment shelter	2	1	2.0
2.13	Allowance for land / right of way	0.5	1	0.5
3.00	Annual operating cost per District HQ			14.7
3.10	Annual maintenance (\$K)			11.6
3.20	Annual cost for power (\$K)	0.7	kWh	3.1
4.00	Annual operating cost per Clan HQ			9.4
4.10	Annual maintenance (\$K)			6.8
4.20	Annual cost for power (\$K)	0.6	kWh	2.6
Notes: [N1] Base construction costs do not include project overhead or contingency allowances. [N2] The relay station does not require a link radio.				

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 17. Rough Order of Magnitude Rural Access Network Assembly Costs for District and Clan Level Extensions

In the next table we provide indicative operating costs for a county broadband network:

#	Parameter (units)	U/C	Qty	Total
1.0	O3b satellite system			
1.1	Tier-1 IP Trunk Terminal site (\$K)	68.8	1	69
1.2	Remote Terminal site (\$K)	13.8	14	193
1.3	Space segment (\$K)	4500	1	4,500
2.0	County PoP (\$K)	36.9	14	517
3.0	Fiber optic network maint. (\$K per km)			
	Margibi, Kakata	0.63	80	50
	Bong, Gbarnga	0.63	150	95
	Nimba, Sanniquelle	0.63	155	98
	Bomi, Tubmanburg	0.63	80	50
	Grand Cape Mount, Robertsport	0.63	150	95
	Gbarpoku, Bopolu	0.88	60	53
	Grand Bassa, Buchanan	0.63	160	101
	Lofa, Voinjama	0.63	305	192
	Grand Gedeh, Zwedru	0.88	250	220
	River Gee, Fish Town	0.88	170	150
	Maryland, Harper	0.88	160	141
	Grand Kru, Barclayville	0.88	95	84
	Rivercess, Cestos City	0.88	90	79
	Sinoe, Greenville	0.88	155	136
4.0	Interface maintenance as % of capital	10%		
Grand total (without contingency)				6,823
Note: The number of interface units (optical line drivers) is a function of the required capacity which varies by year.				

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 18. Rough Order of Magnitude Annual Operating Expenditure Estimates for the County Broadband Network

Please refer to Appendix 3 (Technical Strategy) for additional background, assumptions, and detail including on cost.

5 POTENTIAL FUNDING SOURCES

5.1 PRELIMINARY ESTIMATE OF INFRASTRUCTURE FUNDING REQUIREMENTS

The total external funding availability assumptions and total investment requirements (in USD million) are estimated to be the following:

Phase		External funding sources	Internal funding sources	Total estimated investment
2010	2012	3	\$4.6	\$7.6
2013	2015	8	\$18.2	\$26.2
2016	2018	10	\$39.5	\$49.5
2019	2021	20	\$57.2	\$77.2
2022	2024	20	\$53.3	\$73.3
2025	2027	5	\$5.5	\$10.5
Sum total				\$244.3
External sources include IFI, GoL, UA Fund, Social Development Funds from Concession Agreements, etc. Internal sources are from network operators including joint operations (e.g., private public partnerships).				

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 19. External Funding Availability Assumptions and Total Investment Requirements (USD Millions)

There are somewhat limited sources of funds to pay for the substantial infrastructure costs associated with rolling out high speed internet access. As noted in the previous chapters, the costs to build Monrovia infrastructure are expected to be funded virtually entirely by private commercial investment in the case of the mobile operators and financing arranged by Libtelco, due to the concentrated demand in Monrovia which is likely represents 40-50% or more of national demand.

Roll out of the national backbone connecting Monrovia to the 14 county capitals should attract operator investment on a commercial basis, as the large operators already have microwave links connecting almost all rural county capitals, so we have assumed limited subsidies or support are required. Connecting most rural villages is unlikely to be commercially profitable for an extended period so must either be delayed or require substantial subsidies. In addition to the need for support or subsidies to build infrastructure, additional support is needed for “softer measures” such as the deployment of public access centers, increase ICT education opportunities, and facilitate connectivity to public institutions, among others.

5.2 EXTERNAL AND INTERNAL SOURCES OF FUNDING

Potential funding sources for the rollout of infrastructure to connect Monrovia to rural county capitals and those capitals to surrounding rural villages include:

- Operator direct commercial investment in infrastructure
- Proceeds from GoL divestiture of landing point investment (37.5% of CCL)
- Funding from International Financial Institutions, Government Donors, Private Donors
- Annual operator contributions to Universal Access Fund
- Community Development Funds
- Concession agreements (ie. lay fiber optic cable during Buchanan to Nimba Railway rehabilitation)
- County Funds + Social Development Funds
- West Africa Power Pool (WAPP) (this represents a cost-saving rather than a direct source of funds)
- ECOWAS (for cross border connectivity options)
- International Telecommunications Union

The following table provides an overview of these funding sources which are then described in more detail in the sections which follow:

Potential Funding Sources for Telecom Infrastructure to Distribute ACE and Related Initiatives			
Potential Funding Source	Description	Amount	Comments and Recommendations
GoL selldown of its 37.5% investment in CCL	GoL will apply approximately \$5 million of grant from World Bank to invest in CCL, on condition that it sell this investment to other operators, banks or interested parties prior to ACE launch of service in late 2012. World Bank conditions on GoL grant require that the proceeds of these sales must be applied to the universal access fund (UA Fund)	Approximately \$5 million depending on proceeds of sale.	All GoL proceeds from CCL divestiture should be transferred to UA Fund, for use in funding infrastructure requirements
Funding from IFIs, Government Donor Agencies, Private Donors – either direct into projects or via UA Fund	Potential contributions from IFIs for investment in telecom infrastructure	Not quantified	Transfer funding to UA Fund for specific projects
UA Fund - annual contributions from telecom operators	The policy adopted by the Ministry of Posts and Communications (Part VI, article 6.4) states that a UA Fund shall be established to which all licensed telecom and ICT service providers shall be required to contribute 0.5% to 2% of their revenues annually.	Assuming total revenues of all telecom and ICT service providers to be in the range of \$50 million, this implies total contributions to the Fund in the range of \$250,000 to \$1 million annually.	Establish UA Fund on a priority basis. This would require that LTA adopt regulation establishing the Fund and that a specific % contribution be determined.
Social Development Funds	Concession agreements may require mandatory contributions to Social Development Funds for affected communities of the parties to the agreement.	\$50 million or more annually	UA Fund or the ICT4D Committee make a presentation to the Direct Funds Committee in Monrovia and, of equal importance, visit rural county capitals to hold public information sessions to describe developments regarding high speed internet, sensitize residents to the benefits of obtaining such access, outline specific projects which could be of interest for funding, and answer questions.

Potential Funding Sources for Telecom Infrastructure to Distribute ACE and Related Initiatives			
Potential Funding Source	Description	Amount	Comments and Recommendations
Concession Obligations	Minerals Development Agreements and related agreements signed by foreign investors include specific obligations such as rehabilitation of railways or development of roads.	Not quantified, though substantial	Meet with concession holders to understand their development plans and negotiate (or if necessary obtain GoL mandated obligations) inclusion of telecom infrastructure where appropriate to extend national backbone. Funding from commercial operators or subsidy from UA Fund.
West Africa Power Pool (WAPP)	The joint working arrangement between regional power companies to ensure streamlined power providing within the region and attempt economies of scale in construction of infrastructure	Unknown, but could represent significant savings	Fiber could be provided on the proposed West Africa Power Pool (WAPP) transmission line that will extend through Liberia from Ivory Coast ¹⁵ . This may significantly reduce backbone construction costs on these routes (the WAPP line may be particularly attractive). These savings and routes should be viewed as possible high priority projects to actively explore.
The Economic Community of West African States (ECOWAS)	This regional group of countries (which includes Liberia) has as one of its missions, to promote regional co-operation and integration. The ECOWAS Bank for Investment and Development invests in regional telecoms and other infrastructure projects within the public and private sectors.	Unknown	ECOWAS may be approached for assistance financially in regional cross border connectivity initiatives which could include rural connectivity (perhaps in conjunction with WAPP).
International Telecommunications Union (partner to World Bank)	May provide technical assistance on telecommunications related infrastructure	Unknown	Contact ITU in Geneva to confirm potential funding criteria

¹⁵ SOURCE, D. SHARP MEETING: 2010-04-20 / 1530-1630, Joseph Mayah, Acting Managing Director, Liberia Electricity Corp.: Meeting to discuss plans for re-establishing the national electric grid, and areas of mutual interest.

Potential Funding Sources for Telecom Infrastructure to Distribute ACE and Related Initiatives			
Potential Funding Source	Description	Amount	Comments and Recommendations
Norwegian Aid Organization	Norway is funding reconstruction of Liberia's power generation and distribution grid, being managed by Manitoba Hydro of Canada – see press release on google	Unknown	LEC is including fiber optic cables on the shield ground wire of their high voltage transmission lines (OPGW). They may be interested in co-build and co-finance of this fiber infrastructure. LEC circuits will be used for power system operations. They may consider implementing a commercial communication service.

5.3 UNIVERSAL ACCESS FUND

GoL recently adopted the ICT Policy which states that a Universal Access Fund (UA Fund) shall be established and that licensed telecommunications and ICT service providers shall contribute between 0.5% and 2.0% of their revenues annually to the Fund (in the range of \$250,000 to \$1.0 million assuming total sector revenues of \$50 million). In addition, it is recommended that GoL transfer any proceeds from its sale of its investment in CCL to the UA Fund (as discussed below, we understand this transfer will be required under GoL's agreement with World Bank). We also understand that a major IFI is considering transferring approximately \$3 million to the UAF. These funds can be applied, at least in part if not all, to subsidize investment in distribution infrastructure, by way of open tender processes, as described in the 2007 Act, although more detailed regulations will be required to enable administration of the Fund and clarify the basis on which subsidies may be made available.

5.4 PROCEEDS FROM GOL DIVESTITURE OF ITS INVESTMENT IN CCL

Approximately \$5 million of the GoL's participation in CCL is to be structured as "holding capacity" for other operators, with GoL divesting this participation through sales to other operators prior to launch of ACE service. We expect that the World Bank will require as a condition of this loan that GoL transfer the proceeds of its divestiture into the UA Fund to subsidize projects to increase rural access, including for example O3b.

5.5 CONCESSION AGREEMENTS—DIRECT OBLIGATIONS AND SOCIAL DEVELOPMENT FUNDS¹⁶

Concession agreements¹⁷ can contribute substantially to the development of telecom infrastructure in two principal ways:

- direct obligations for specific infrastructure projects can be included in the agreements; and
- mandatory contributions to Social Development Funds for affected communities can be required of the parties to the agreement.

To date, Liberia has missed an opportunity to expedite the development of critical telecom infrastructure within Liberia as these concession agreements have not considered the development of telecommunications as an adjunct to the other services provided. For example, we understand that ArcelorMittal is required to rehabilitate the railway from Buchanan to Nimba, and it would have been inexpensive to request or subsidize ArcelorMittal in the laying of fiber optic cable along the track. Many of these operations require transport and communications systems between the mine and port sites for example, and even between intermediate processing sites. It is not uncommon for fibre to be included along their transport routes for internal operations, but additional fiber is likely to be installed for future use even as potential fiber swap assets.

If all concessions being contemplated by GoL are successfully concluded, we understand that at least \$50 million annually (likely more)¹⁸ could be contributed by concession holders to various social development

¹⁶ This information was compiled from an interview on June 30, 2010 with Mr. Solani Mwenechanya, Ministry of Lands Mines and Energy, IBI (GEMAP) Minerals Concessions Expert. Email: smwenechanya@ibi-usa.com

¹⁷ The adoption of the 2005 Public Procurement and Concessions Act introduced an open and competitive tender system, operating under the GEMAP programme, for issuing all concessions for Liberian public resources such as minerals, timber, fisheries and agriculture. This Act provided the impetus in 2006 to commence negotiating concession agreements regarding seven large mineral deposits in Liberia.

¹⁸ Mr. Solani Mwenechanya, Ministry of Lands Mines and Energy, IBI (GEMAP) Miner¹⁸ This information was compiled from an interview on June 30, 2010 with Mr. Solani Mwenechanya, Ministry of Lands Mines and Energy, IBI (GEMAP) Minerals Concessions Expert. Email: smwenechanya@ibi-usa.com

funds across Liberia.¹⁹ This would represent in the range of 1.5% to 2% of total concession fees paid. It is critical that the telecom sector obtain a “seat at the table” when concession agreements are being negotiated by GoL in order to ensure that concession funding contribute to roll out of telecom infrastructure. To achieve this, it is important that the Inter-ministerial Concessions Committee understands the needs of the telecom sector and supports these as a priority during concession negotiations, even investigating now whether fiber assets exist that may be used more immediately.

In Appendices 4 and 6 we have considered how concessions might be useful to the development of more established telecommunications infrastructure. The concession holders themselves are (or will likely be) obligated to undertake substantial infrastructure projects. The work being done by GoL in rehabilitating Liberia’s power potentially provides opportunities for telecom infrastructure to “piggyback” fiber optic cables on power system transmission lines²⁰. Donors have shown interest in power projects in Liberia and should be encouraged to take into consideration the links between power grid rehabilitation and roll out of new telecom infrastructure. The Lands, Mines and Energy Ministry (LME) and the Liberia Electricity Corporation (LEC) signed a US\$50 million management agreement in April 2010 with Canadian power utility, Manitoba Hydro International Limited, to increase electricity supply in Monrovia. The GoL's objectives for the contract included to provide access to electricity to 30% of the population of Monrovia by end of 2015. The management contract will be funded by the World Bank, United States Government and the Government of Norway.

The Consultants recommend that the UA Fund jointly with the ICT4D Committee meet with Manitoba Hydro to discuss opportunities for joint power and telecom infrastructure projects. Priority should be given to infrastructure outside Monrovia linking rural capitals and to regional cross border power initiatives as these will provide attractive opportunities to twin fiber optic cable with power cable. This infrastructure may also assist in supporting useful competition for ACE after it is launched.

¹⁸ The adoption of the 2005 Public Procurement and Concessions Act introduced an open and competitive tender system, operating under the GEMAP programme, for issuing all concessions for Liberian public resources such as minerals, timber, fisheries and agriculture. This Act provided the impetus in 2006 to commence negotiating concession agreements regarding seven large mineral deposits in Liberia.

¹⁹ In addition to the Social Development Funds, GoL provides annual funding to each county, however these funds are directed by a separate county development committee and primarily used for operating expenses, so the component available to invest in projects such as telecommunications would be small.

²⁰ If there is no commercial power available, then network operators must “spin diesel” to power microwave backbone and access network base station sites. This makes power a significant capital and operating expense line item for communication networks. Clearly extension of the national power grid will have direct benefits to the telecommunication sector. In meetings with Lonestar (an MTN company), they suggested over-sizing base station generators and selling capacity to local communities [M16]. It was also noted that the MTN Foundation has provided charitable social services, including, as an example, providing power to schools that are near their base station sites. This idea was discussed with LEC [M22]. This concept actually has a good fit with LEC policy and planning. LEC will provide core power generation, transmission, and distribution facilities. Independent power producers (IPPs) will be encouraged to contribute to generating capacity. Essentially, mobile operators would be encouraged to become IPPs in remote areas. LEC would participate by constructing the power distribution systems. The power distribution systems would be built to national standards and would be in place and ready for the eventual arrival of the national grid. How keen the mobile operators would be to set up business units to facilitate this model remains to be tested. Another area of potential cooperation between LEC and the telecommunications sector involves the deployment of “smart grid and smart metering” infrastructure. Since virtually all electrical power infrastructure was destroyed or neglected beyond repair during the conflict period, LEC will be re-constructing the power system in a nearly “greenfield” situation. LEC intends to build state of the art, including provisions for the communications network needed to monitor and control the power system. In general, this means deploying fiber optic cables to the distribution substation level. However, extending communication from the substation to “field devices” that are used to monitor and control the power system, including customer meters, does not have a single ready made solution. One solution for this extension has been to exploit cellular mobile communication networks.

Other similar projects open possibilities to “piggyback” the laying of fiber optic cable at relatively low cost, for example:

- ArcelorMittal has agreed to rehabilitate the Buchanan to Nimba railway for use in transporting iron ore and other resources from Bonga, Nimba, Guinea and possibly elsewhere.
- Putu ore deposit which is expected to be developed by Mano River Resources²¹ is expected to build a railway to Robertsport.
- China Union is expected to rehabilitate and later expand the railway connecting Bonga to Monrovia, which is already in operation but requires repair

The challenge is to convince the county committees of the importance of investment in telecom infrastructure and other initiatives. The Consultants recommend that the UA Fund or the ICT4D Committee make a presentation to the Direct Funds Committee in Monrovia and, of equal importance, visit rural county capitals to hold public information sessions to describe developments regarding high speed internet, sensitize residents to the benefits of obtaining such access, outline specific projects which could be of interest for funding, and answer questions. The goal would be to build understanding and support among those who decide on the allocation of the Social Development Funds and their constituents, for investment in telecom infrastructure to distribute ACE as well as related projects.

5.6 WEST AFRICA POWER POOL (WAPP) AND FUNDING FOR ELECTRICITY GRID DEVELOPMENT

WAPP was created by ECOWAS²² to address regional deficiencies in power supplies. WAPP’s vision is to integrate the national power system operations into a unified regional electricity market in the hopes that over the medium to long-term, citizens of ECOWAS Member States will have access to a stable and reliable electricity supply at affordable costs, by, amongst other things, facilitating the balanced development of diverse energy resources of ECOWAS Member States for their collective economic benefit, through long-term energy sector cooperation, unimpeded energy transit and increasing cross-border electricity trade.

The WAPP Secretariat is tasked with:

- the development and approval of clear, measurable standards to harmonize electricity planning and operation of pooled electric systems in ECOWAS Member States;
- effective programming for enforcing compliance with mandatory standards;
- improving cross-border and reliable flows of electricity in ECOWAS Member States among electric system operating organizations; and
- effective communication and information sharing.

²¹ Mano River Resources recently sold a controlling interest to Severstal, a Russian conglomerate.

²² The Economic Community of West African states which has as one of its objectives, regional co-operation supported by funding from their banking arm, of regional infrastructure projects.

Some of WAPP's objectives, many of which can be echoed by Liberia and absorbed into the telecommunications sector to enable joint working across both sectors, are to:

- improve the reliability of power system and quality of power supply in the region as a whole;
- minimise operating cost of networks;
- increase investments needed for power grid expansion in the region, with emphasis on the implementation of cross-border projects;
- create an attractive environment for investments in order to facilitate the funding of power generation and transmission facilities;
- create a common operating standards and rules in the sector; and
- increase the overall level of power supply in the region, through the implementation of priority generation and transmission projects that will serve as foundation for economic development and the extension of cheaper electricity supply to a greater number of consumers.

It would obviously be appropriate, having regard to what we say above in relation to concessions, if regional concessions in relation to infrastructure for power could also include fiber for telecommunications networks, and an approach to WAPP should be made in this regard.

6 REGULATORY REQUIREMENTS

Simply introducing high speed internet capacity to Liberia via the landing point and then distributing it to Liberians is insufficient to ensure that Liberians obtain reasonably-priced, reasonable quality internet access, if there is no competition to ACE or no oversight over the terms of supply. Kenya provides a cautionary example in this regard: Kenyans only obtained truly low cost internet access after a fourth cable, EASSy, was about to commence service in early 2010 – before that time, private operators maintained relatively high prices for internet access for lack of incentive to reduce them.

Given that there will be limited or no effective competition to ACE in the provision of low cost high capacity internet in Liberia for many years, a strong regulatory regime is needed. This regime will need to include the terms on which the ACE cable landing point is licensed, and more than likely will require that LTA control prices at both the wholesale level (for example service to other operators, banks and large NGOs) and retail level (service to individual or SME-type subscribers). In effect, the prices at which operators will be permitted to offer internet access should be limited (for example by way of price ceilings) in order for as many Liberians as possible to obtain affordable internet access at reasonable prices.

This will require a balancing act so that operators are nonetheless encouraged to build new infrastructure to distribute access to new geographic and demographic markets. In essence, maintaining low or cost-oriented prices will encourage operators to reach out with infrastructure to obtain access to new customers and markets within Liberia. If operators are permitted to sell internet access at high prices they will have little incentive to invest in new infrastructure to reach new subscribers – profits from existing customers would continue to be substantial, but taking this into account, price controls must be reasonable and oriented towards costs without hampering the operators' ability to use profit margins for expansion.

6.1 REGULATORY RECOMMENDATIONS

The following steps need to be considered for implementation by GoL and LTA in order to ensure operator concerns are addressed, Libtelco's role is clarified and limited, GoL's policy goals are aligned with the sector's and vice versa, and LTA has the powers and authority that it needs to carry out the changes and implement the policy that the cable landing will require:

- *A universal access regulation.* The 2007 Act provides that LTA may prescribe and the Minister may approve a regulation which establishes the Universal Access Fund to be used to subsidize, in whole or part, the net costs of providing universal access²³. LTA will be required under the 2007 Act and under the ICT Policy, to develop regulations in terms of which it requires contributions from operators to the Fund, determine priorities for the Fund to focus on (such as the distribution of broadband infrastructure to rural county capitals and between them), invite bids for identified projects, and assess the terms on which subsidies may be made available in relation to these projects. Monitoring the application of the subsidies will of course also be critical to ensure they are correctly and efficiently applied.

²³ Section 23 of the 2007 Act.

- Licensing of Cable Landing Point. CCL will itself require a licence in order to ensure that it is authorized to do all such things and to operate all such technologies as may be required. It will need authority in the form of a license issued by LTA under the Telecommunications Act, 2007²⁴ (the Act) which gives it rights to install, own and operate international facilities and to make services over the cable landing point available to requesting parties including members of CCL itself. This may be an international gateway licence or a cable landing station licence. In future, it will be important to ensure that all categories of individual network licence (including the licence granted to CCL) are technology-neutral and not unduly restrictive²⁵.
- Universal Licenses for Operators. Flowing from the licensing point above, all operators that distribute ACE internet capacity will require universal licenses (or at the least upgraded 3G and 4G licenses) in order to be in a position to deploy the wireless technologies required to connect Liberians to ACE on the most cost effective basis.
- Law. Changes to the Act may be required to recognize that the landing station is an “essential facility” and to endow LTA with powers to regulate the entity with control of that facility through appropriate controlling conditions on CCL’s operation of the landing point and the terms on which capacity is made available.
- Competition framework. It may be useful to begin the review of the Act with a review of the competition framework provided for within the Act to determine the extent to which LTA can use that framework to:
 - Determine a relevant market for international broadband services
 - Determine the cable landing point to be an essential facility
 - Define dominant operators as (i) having significant market power in the relevant market, and/or (ii) control of an essential facility
 - Determine appropriate conditions to be imposed in the licences of dominant operators to control dominance and mandate access
 - Introduce price regulation to limit the maximum prices that may be charged by dominant operators for (i) access to the cable, and (ii) co-location and interconnection, and (iii) downstream services (wholesale and retail).
- Assessing dominance. At the stage when the framework is in place, LTA will need to determine that CCL is dominant by virtue of its control of essential facilities, and the members of CCL who currently are anticipated to have exclusive rights to capacity on the cable, may also be regarded as having significant market power in the market for international broadband capacity. As a result, any agreements concluded by them should not restrict or determine prices at which capacity may be sold which are greater than cost plus a reasonable margin, nor should these prices be predatory (although in the Liberian market this is far less likely). These determinations must be published and consulted on and later incorporated into regulations and/or licence conditions.

²⁴ Liberian Telecommunications Act, 2007, Article **15. Requirement to Hold License** (1) No person shall: (a) provide a telecommunications service to the public for direct or indirect compensation; or (b) own or operate a telecommunications network used to provide a telecommunications service to the public for direct or indirect compensation.

²⁵ Currently mobile operators are required to use 2G and GSM technology in the main (this is prescribed in their licences), and Lonestar does not have authority to resell capacity to corporate users. This is unnecessarily restrictive and runs counter to international trends in terms of which regulatory authorities facilitate convergence by permitting operators to use any technology to provide any service.

- Detailed infrastructure/facilities regulation. It will also be important for LTA to consider how to regulate domestic leased lines, the provision of spectrum for microwave point-to-point links, the right to dig trenches for cables, and access to roof space for antennae, access to ducts and trenches, access to premises at the cable landing point for interconnection and backhaul, and service provision to consumers and intermediary service providers. All operators appear to agree that infrastructure-sharing will save operators substantial costs.
- Price regulation. A cost model may be needed to assist LTA in the determination of a “reasonable” price or maximum price for wholesale and retail access on a cost plus basis, or on an internationally acceptable basis for capacity resale in these circumstances. This may require the introduction of a glide path towards the maximum prices which can be charged during at least the first few years after ACE Ready For Service date. Alternative price regulation strategies may be implemented by LTA. For example, maximum prices can be set which would fall rapidly during the first several years as expected volume of capacity usage increases while costs remain relatively static. Alternatively, a relatively flat schedule of prices may be introduced in the first few years, which provides a substantial incentive for operators to increase volume.
- Transparent plan. We believe it will be important for LTA to issue guidelines sooner rather than later, indicating what steps it may take to create a suitable regulatory framework for access to the cable and related facilities, access to associated networks, and the cost of capacity.
- Accompanying steps. The necessary public consultations and market and cost research should accompany each step.

6.2 WORLD BANK TECHNICAL ASSISTANCE TO LTA

Assuming Liberia proceeds with ACE membership, the World Bank intends to provide funding for technical assistance to LTA to develop the regulatory framework to support ACE and distribute affordable connectivity across Liberia. Using the World Bank funding, LTA will engage a consulting firm to advise on development of the regulatory framework which can be expected to include the following components (flowing from the previous section):

- a license for CCL to operate, maintain and distribute the capacity of the ACE landing point
- wholesale and/or retail price controls on the sale of capacity by CCL and also similar price controls on operators which distribute ACE capacity that they purchase from CCL;
- upgrade of licenses of operators to “universal”²⁶ licenses or 3G licenses in order to enable them to roll out the wireless, 3G and NGN infrastructure needed to distribute ACE capacity; and
- establishment of a Universal Access Fund as envisaged by the 2007 Act and the National Telecom and ICT Policy 2010 in order to subsidize investment by operators in the infrastructure needed to distribute ACE.

The steps outlined in the section above comprise the Action Plan for developing the regulatory regime to support ACE and CCL. The full Action Plan in Appendix 1 includes timelines and further detail regarding this plan.

²⁶ The universal licence is a model of licence which permits licensees to provide any form of service using any form of technology – it is the licence which facilitated technological convergence. This form of licence has been granted in other countries in Africa including Nigeria and South Africa, and many countries are moving their regulatory regimes towards this licence model in order to accelerate the development of their markets.

7 CONSTRAINTS ON INFRASTRUCTURE INVESTMENT

In other countries grappling with the need to accelerate the rollout of broadband, the main broadband deployment constraints are often determined to be:

- Bandwidth availability.
- High cost of bandwidth (particularly international).
- The prevailing licensing regime and various licence costs.
- Spectrum constraints
- Low levels of PC penetration and ICT literacy
- Inadequate infrastructure, including electrical power
- The main broadband uptake / usage constraints are:
 - The quality of broadband services (more important to the business market segment).
 - The geographic availability of broadband services.
 - The high cost of retail broadband services (particularly among residential users but also small companies)

In Appendix 6 we have considered these constraints in greater detail. In this chapter we have set out a summary of the key impediments and indicated how we recommend that they could be overcome.

7.1 INSTITUTIONAL AND REGULATORY IMPEDIMENTS

7.1.1 Regulatory Uncertainty which Increases Risk of Investment

Recommended Action: The technical assistance to be provided by World Bank to LTA to establish a clear regulatory regime for CCL and operators (detailed in Appendix 5 of this Report) will substantially address this concern, however this obstacle to investment will only be fully addressed with the passage of time as LTA implements a full cadre of regulations and maintains its independence across several consecutive boards of commissioners. It will also be appropriate for LTA to maintain a good body of precedents and ensure certainty by deciding similar matters along similar lines. Where regulations are required or where changes are proposed, maintaining clear lines of communication, making public any work plans, and allowing sufficient time to consult will be important.

7.1.2 Excessive Licensing and Frequency Fees which burden Licensees and Investors

Recommended Action: Develop licensing fees and regime for CCL and operators which are based on international best practice and benchmarking of fees in comparable jurisdictions with a view to minimizing licensing fees and encourage operators to invest as much as possible in infrastructure²⁷.

7.1.3 Challenges to Telecom Regulator

Recommended Action: In order to further confirm LTA's independence, we recommend that the Act be amended to clarify the independence of financing for LTA's operations. In order to further insulate LTA from political pressure, this funding should ideally come exclusively from license and other operator fees paid to the central government fund and allocated in accordance with Ministry of Finance guidelines.

7.1.4 National Operator Provisions in Draft ICT Policy May Deter Investors

Recommended Action: We recommend that Libtelco's status as National Operator be terminated as soon as possible and that the ability of the GoL to designate any operator as a National Operator be deleted from the Act. For certainty, the Consultants note that the Act must also be amended to delete Article 13(2), which designates Libtelco as a National Operator, and delete Article 12, which authorizes the designation of any licensee as a National Operator at any time unless the Article is amended to stipulate the circumstances in which such a designation may take place, and the type of obligations that might be imposed upon a service provider designated as a National Operator. The other substantially less attractive option, is to maintain the designations but clearly limit the extent of these obligations as to scope and time of application, to reduce risks to banks and other potential lenders.

7.1.5 Lack of Clarity on Spectrum for New Technologies and New Entrants

Recommended Action: We recommend that LTA adopt spectrum regulations to facilitate LTA's review of spectrum allocations to ensure spectrum is being used efficiently; no amendments to the Telecom Law are necessary. Such spectrum regulations were drafted in 2006 and redrafted in 2008 by international experts with LTA, but have not yet been implemented. These regulations should be updated to ensure that they address the need to review, re-allocate and re-farm spectrum based on a consistent, transparent and principled process addressing utilization, efficiency, economic and technical impact, and other issues. This review should include spectrum which may be reserved for use by GoL (for example for security purposes) and that allocated to licensed operators. Any frequency that is identified as being inefficiently used, or requiring reallocation to support new technologies could then be reallocated to more efficient use.

7.1.6 Need for Licenses for all Service Providers acts as a Barrier to Entry

Recommended Action: Amend the Act to eliminate the requirement that all service providers obtain licenses or alternatively create two categories of licence – an individual and a class category. Require only operators which use scarce resources such as spectrum, number or land or those which have or are likely to have a significant socio-economic impact to obtain individual licenses, the remainder need only

²⁷ Given that GoL policy prioritizes ICT development, there should be no dis-incentives to infrastructure development. It should be noted that the following cost items are NOT specifically included in the business model set out in Chapter 4: (i) license fees including for offering services, operating networks, or spectrum; (ii) customs and import duty; (iii) building permits; (iv) value-added or general sales tax; and (v) unofficial taxes or illegal payments and bribes. Further, land acquisition and right of way acquisition costs have been assumed to be minimal. If applicable, these cost items add to the initial capital cost and can be factored in by applying a multiplier to the capital cost estimates.

register or notify LTA that they intend to provide service and they should then be required to comply with published terms and conditions of general application – they will be authorized under a class licence.

7.1.7 Need to Designate CCL as Essential Facility

Recommended Action: If there appears to be any uncertainty regarding LTA's ability to complete the market analysis required to designate CCL an essential facility and issue this designation prior to commercial launch, we recommend that CCL be designated as an essential facility by way of an amendment to the Act determining all cable landing points to be an Essential Facility on an interim or transitional basis until LTA has completed a market analysis of the facility to determine if a separate market exists (it obviously does) and that CCL has dominance in that market (it obviously does). This would avoid a potential situation where CCL or other operators might challenge LTA's authority to regulate the prices of CCL or ACE capacity offered by other operators. The previous chapter addresses the need for LTA to regulate the prices of CCL. Such transitional provisions are common in new telecom laws and make sense for this new facility, unless it is clear that LTA will complete its market analysis prior to launch of service by CCL in late 2012 and be ready to regulate essential facilities.

7.1.8 Validity of LTA Decisions during Appeal Unclear

Recommended Action: We recommend that Article 78(2) of the Act be amended to state that LTA's order remains in effect during any court review until a final decision is made on the matter. This will support LTA's ability to effectively regulate the sector and support a competitive market environment.

7.1.9 Enforcement of Infrastructure Sharing, Access and Interconnection Regulation

Recommended Action: the LTA regulations regarding facilities-leasing must be implemented without delay. LTA should publish guidelines indicating in what circumstances it will expect infrastructure-sharing. Costs of this sharing should be proven by the party seeking to avoid sharing, so that the actual cost of provision as opposed to the cost of construction or an unrelated figure, can be approved. Dispute resolution can now be handled under the LTA dispute resolution regulations, and delays of any sort by licensees in responding to requests for information or to dispute resolution calls, should not be tolerated. If necessary LTA must impose penalties on non-compliant operators as a warning and incentive to comply in future.

7.2 COMMERCIAL IMPEDIMENTS

7.2.1 No National Electricity Grid

Recommended Action: Reinforce and fund the national commitment to invest in electricity infrastructure across Liberia. Focus this infrastructure on identified Development Corridors as described in Chapter 3. Share infrastructure rollout costs with telecom operators where possible, under concession agreements, for example by stringing fibre optic cables alongside electricity cables, as described in Chapter 5.

7.2.2 Customs and other duties on import of telecom equipment and computers

Recommended Action: Eliminate or substantially reduce customs duties and VAT on all imports of computers, telecom equipment and handsets for a specific period, for example 5 years. We have been advised that the customs duties for this type of equipment are in the range of 30% depending on the specific equipment type. GoL should encourage operators to obtain equipment certification from LTA and LTA should in turn, create streamlined procedures for certifying equipment for this purpose. We understand that for ACE-related equipment, GoL has indicated a willingness to consider permitting CCL to import equipment to Liberia tax-free. Operators that obtain a universal license or 3G licence in due course should also receive tax incentives for roll out of infrastructure to distribute ACE capacity (limited

to telecom equipment, not supporting infrastructure or building materials for example). This will require the co-operation of the Customs Authority and the Ministry of Finance. To avoid abuse by operators of tax-reduced import permissions, any operators importing telecom equipment and requesting reduced tax could be required to obtain certification by LTA that they are in fact importing telecom equipment.

7.2.3 High Cost of Importing Telecom Equipment other than Customs

Recommended Action: Impose GEMAP type discipline on the Customs Authority to reduce potential for corruption at the Port of Monrovia and other entry points for telecom equipment.

7.2.4 Limited Mechanisms to Facilitate eBanking and eCommerce

Recommended Action: Review Liberian laws to determine where improvements can be made and if new laws and regulations are required, including with respect to ePrivacy, eBanking, eSignature and Agent Banking. Commence this process immediately in order to facilitate eBanking and eCommerce initiatives such as the Mobile Money project recently launched by Lonestar. Review demand for eBanking services and consider an education programme in conjunction with banks and operators, to increase the number of consumers with bank accounts and phones. Consider measures to capacitate the Central Bank over the next 2-3 years, including authorising bank agents to sanction transactions up to a particular limit, or to facilitate transactions such as transfers, by operators of a certain kind. Mobile banking is a project of such significance that further work should be conducted in this regard to determine how best this may be supported and implemented in Liberia from a technical, legal and commercial perspective. Such a project will require co-operation between LTA, the Minister of Communications and Finance, and other stakeholders in the banking, communications, and consumer sectors.

7.2.5 Limited Uptake of Internet Access/Provision/Usage in Liberia

Recommended Action: the steps to be taken in this regard have largely been covered in other sections, save to reiterate that education will be critical in incentivizing internet take-up.

7.2.6 Constraints on Operator Access to Financing for Infrastructure Investment

Recommended Action: We recommend that GoL consider measures to encourage increases in the capital and lower costs within the banking system, for example:

- License additional banks including foreign or international banks, and remove any requirements that banks conduct all operations within Liberia;
- Encourage development of banking systems and marketing programmes to capture deposits and pay interest on funds of both urban and rural residents who are often recipients of substantial international remittances;
- Expedited implementation of ePayments system now being reviewed by GoL;
- Investment by banks in internal internet networks to support funds transfers and reporting.

7.2.7 Lack of Other Basic Infrastructure in Rural Areas

Recommended Action: It will be important to ensure wide coordination between different branches of Government, as well as the private sector, in infrastructure investment and upgrade programs, especially as new technologies and network are introduced further into rural regions. Ideally, where construction projects are contemplated, such as roads, railroads and electricity, these can be tied together with planned rollouts of telecommunications networks and services, to minimize duplication of effort and costs. The rehabilitation of the railway from Buchanan to Nimba under concession agreements provides an important opportunity to “piggyback” on other infrastructure development to expand Liberia’s national

backbone. The Universal Access Fund could play a leading role in promoting such coordinated efforts with a view to providing subsidies if required.

7.2.8 Limited knowledge about ICT for development among policy decision makers

Recommended Action: It is often noted that policy and decision makers are not fully informed about the benefits of ICT for development, particularly the role of ICT as tools to facilitate development across sectors. It is therefore important to develop a strategy to increase the level of knowledge about ICT for development among decision makers. Such strategy should include capacity building opportunities for policy decision makers, as well as incentives to participate in awareness raising activities. For this reason, we recommend the development and implementation of **a program to identify ICT Champions with the responsibility of increasing awareness and promote the use of ICT in the development of Liberia**. These Champions should also include individuals from the Government of Liberia who have acquired significant knowledge and that should be charged with sharing such knowledge with their colleagues. A number of Government representatives, among others, would be responsible to implement activities to raise awareness and educate different groups in Liberia about the benefits of ICT for development. These activities could take different formats, from seminars to working lunches to share knowledge and expertise. As part of this program, a custom training activity could be developed specifically for policy and decision makers involved in projects that use or depend on the use of ICT, such as e-health or e-education programs.

7.2.9 Lack of trained ICT Professionals outside urban areas

Recommended Action: Access to trained ICT professionals is a major concern outside urban areas, even when some form of technical support may be available through online tools. Based on experience elsewhere in Africa (e.g., Mozambique), partnerships between operators and local institutions are a key component to successful universal access projects in rural and remote areas, including as a strategy to address limited technical resources. Local institutions have greater knowledge of the communities, understand the local market better, and have links to the community that are necessary to ensure success and adoption. Partnerships are particularly beneficial as they provide a model for sharing infrastructure, management and critical technical staff at all times, even when that technical staff is trained and paid by the service provider. For example, internet service providers may partner with existing businesses, such as local cafes, movie theaters or other community service providers, as a way to share facilities, security and technical ICT staff, and most importantly to share customers (who are already used to attend such businesses). By sharing resources, service providers can ensure access to technical staff on a timely manner, as there may not be enough ICT professionals in the particular area.

7.2.10 Lack of relevant Information Content

Recommended Action: It is important to facilitate access to information via the internet. However, such information needs to be relevant to rural populations and provided in a format that is clear and understandable to them, including in the required languages and/or formats that make it accessible to a wide diversity of groups (e.g., video, spoken language). Local and meaningful content is critical to ensure demand for and a market for ICT services and applications. It can serve as an opportunity to build local capacity and/or support local businesses interested in content development for their communities, and delivered via ICT networks, including radio. Therefore, we recommend that a program focused on the development of Content and Applications for rural Liberians be implemented and funded by the UA Fund as part of the proposed strategy to bridge the urban-rural divide and integrated into a wide universal access strategy in Liberia (see Appendix 7 for details).

8 MOBILE BANKING

8.1 SUMMARY

Prior to the civil conflict, Liberia operated to some extent as a regional banking center in West Africa, benefiting from its ties with United States, English language proficiency, and maritime registry which attracted international funds flows, all of which contributed to a comparably healthy banking center relative to other countries in the region. It is important that the Liberian banking sector regain its health in order to play a supportive role in funding private and public investment in critical infrastructure for Liberia such as telecommunications backbone and electricity grid. In addition, banking infrastructure in rural Liberia is limited and less profitable than urban infrastructure; if mobile money services are launched in Liberia they will enable Liberia more easily among other things, to bank the rural poor and extend the benefits of mobile lending.

This report provides recommendations to support growth in the Liberian banking sector and mobile banking, with the following objectives:

- expand the use of the electronic communications infrastructure needed by banks and telecom operators to provide banking services in rural areas (such as mobile banking access to credit, earn interest on deposits, make payments, buy insurance, and even create personal investments);
- assist in bridging the urban–rural divide by bridging the gap between Liberia’s banked and unbanked population; and
- encourage the development of Liberia as a regional banking center.

8.2 LIBERIA BANKING SECTOR OVERVIEW AND DEFICIENCIES

The following provides a brief overview of the Liberian banking sector at present (noting that some of these factors may be duplicated in the section below dealing with general impediments to rolling out mobile banking):

- **Number of banks and capacity is limited.** A total of eight banks are registered in Liberia, of which six are Nigerian-owned, and two Liberian-owned. Liberian banks are at very early stage of development, using simple systems, and may have limited capacity to increase system complexity without substantial outside assistance.
- **Practical difficulties in vetting customers.** Confirmation of a person’s identity is difficult, as many people in Liberia have assumed the identities of others during and since the civil conflict.
- **Total capital available in Liberia is inadequate.** Total capital within these eight banks is in the range of \$65 million, which reflects initial capital invested as well as substantial losses in the past two years due to the impact of the Global Financial Crisis. This capital level is extremely small to support Liberia’s financing needs, let alone support Liberia’s role as a regional financial capital. In addition, although successful introduction of mobile money operations in Liberia may reduce GoL expenditures, there may be resistance by existing banks, as GoL is currently subsidizing remote rural bank branches through the provision of buildings, electricity, security which are available for sublet by any bank. Any withdrawal of this subsidy could hurt banks.
- **Nigerian bank losses have negatively impacted the availability of capital in Liberia.** Nigerian-owned Liberian banks have access to additional capital from Nigerian parents, however given recent instability and losses in the Nigerian banking sector, this support may be limited.

- **Regulatory restrictions may stymie investment.** Regulatory limits have been placed on how much individual banks can invest in any one project, in order to ensure stability and diversification of risks. An unintended consequence is that these limits will limit operators' ability to raise funds locally. In addition, we were advised that it is difficult as an international bank to start a bank in Liberia because all operations currently are required to be in Liberia. For this and other reasons, no large international banks currently operate in Liberia.
- **Lonestar banking service is still in pilot phase.** As of early July 2010, the only mobile money operation in Liberia currently (Lonestar "Mobile Money") is in a pilot project phase and available only in Liberian dollars to Lonestar employees.²⁸ Lonestar's platform, Fundamo, provides a comprehensive solution. The Lonestar service is currently available only on mobile phones but can also be integrated into smartcard and other channels and can be used to seed new broader initiatives. Based on interviews conducted by IBI, we understand that Lonestar has indicated it does not need to earn a profit from this business directly, but would prefer to increase the number of services or applications which use the Lonestar platform. This approach can be contrasted to the Kenyan experience; Liberia will not benefit from the economies of scale available in far more populous Kenya. As a result of expected limited Liberian demand, Liberian operators need to ensure that the marginal cost to operators is small.
- **Current broadband constraints hamper transactions.** Existing high cost, low bandwidth international broadband connectivity limits international transactions such as payments, transfers of funds, credit checks, loan reporting, shareholder reporting. These limitations can be expected to reduce investor willingness to provide additional capital to the Liberian banking sector.
- **Physical distance between banks and communities is significant.** Most Liberian bank branches are located distant from poor rural communities, limiting the access of rural resident to banking services. There is a lack of rural infrastructure or systems to lend to rural inhabitants or support substantial microfinance initiatives. As a recent IBI report notes: "The shortage of bank branches means a high percentage of payees are unbanked, since making simple transactions such as cash withdrawals and deposits would involve long traveling. Payees rely on traditional non-banked saving methods, such as keeping it at home, which incur high cost and security risks (e.g., theft, robbery. In fact, although the payments go to benefit payees in rural areas, this payment system does not benefit the development of the local economy. When payees receive their cash, they tend to do their shopping right there before going home. Saved money may also be brought all the way to towns with bank branches. The local areas end up with a lack of cash for economic transactions."²⁹
- **High interest rates in Liberia.** Interest rates in the range of 12-14% for higher quality projects, limit investment by entrepreneurs and companies, who at times are forced to obtain capital from outside Liberia (United States, Lebanon, etc.) or forego attractive investments due to lack of financing.

²⁸ Anthony Waddell, IBI consultant, *Mobile Payments System for Government of Liberia*, Interviews June 2010. Also *A Mobile Payment Model for Government of Liberia*. Draft Report. March 19, 2010. IBI International, prepared by Ying Wong.

²⁹ Also *A Mobile Payment Model for Government of Liberia*. Draft Report. March 19, 2010. IBI International, prepared by Ying Wong.

8.3 BENCHMARKING LIBERIA AGAINST MOBILE MONEY INITIATIVES IN OTHER DEVELOPING COUNTRIES

Mobile money services have experienced rapid growth in many African countries. Recent developments in other parts of Africa underline the potential of mobile money to contribute to the development of Liberia's economy and rural areas:

- More than 500 million people internationally will rely on mobile money transfer services by 2014, mainly in developing countries.³⁰ The GSM Association estimates that telecom operators could earn \$5 billion from financial services by providing banking services to 364 million “unbanked” people by 2012.
- MTN Uganda, with 60% market share, expects users of its mobile money services to grow from almost 900,000 users to 3.5 million users by 2012 and approximately 16% of MTN Uganda's subscriber base uses its mobile money service.
- MTN Ghana also launched MTN Mobile Money service in Tamale, the Northern Regional capital,³¹ partnering with various African banks to develop the service, including Ecobank, Fidelity Bank, GT Bank, CAL Bank, Stanbic Bank, Zenith Bank, United Bank for Africa (UBA), Merchant Bank and Intercontinental Bank.
- Approximately 11 % of Kenya's GDP is transferred by 9.5 million people³² (or 23% of the population) using mobile money through Safaricom's mobile telephone based money transfer service called M-Pesa, which plans to launch similar services in South Africa soon. The Central Bank of Kenya recently licensed MobilePay (Tanzaga), a new money transfer system which allows transactions across Safaricom, Yu, Orange and Zain.³³ Subscribers will be able to take deposits and withdraw cash through trust accounts in Kenya Commercial Bank. In Nigeria, eTranzact partnered recently with International Finance Corporation (IFC), a member of World Bank Group, to start a pilot project for the rural areas in Nigeria called Rural Telephony Project (RTP) MobileMoney.³⁴ The project is designed to bank unbanked residents in Nigeria and other parts of Africa. The Central Bank of Nigeria is expected to approve licenses in 2010 for banks to commence pilot projects for mobile money.³⁵
- The National Bank of Abu Dhabi (NBAD), has partnered with MoneyGram International to support mobile phone international remittances to over 200,000 locations across 190 countries and territories.³⁶ Banque Populaire du Rwanda, the leading Rwandan bank based on branch network will roll out Mobile Banking in August 2009, enabling banking clients to transfer, send and receive money from different places around the country in partnership with MTN Rwanda, using their mobile phones.³⁷

³⁰ Juniper Research.

³¹ MTN launches Mobile Money Service in Northern Region – Ghana, by Joseph Ziem. Mobile Money online magazine. June 22, 2010.

³² The Economist: Economist Intelligence Unit - Executive Briefing. Banking on mobile phones: Out of thin air. The behind-the-scenes logistics of Kenya's mobile-money miracle. June 14, 2010.

³³ CBK Licenses Another Cash Transfer Service Firm in Kenya. Mobile Money online magazine. June 10, 2010.

³⁴ “IFC Partners eTranzact on MobileMoney Project in Nigeria” Mobile Money Online Magazine. June 21, 2010.

³⁵ Mobile Money: promoting regulatory harmony in Nigeria. Mobile Money online magazine. June 5, 2010.

³⁶ NBAD and MoneyGram launch international money transfer via mobile phones. Mobile Money online magazine. June 22, 2010.

³⁷ BPR to Roll-Out Mobile Banking in Rwanda by Saul Butera, Mobile Money, June 5, 2010. BPR is 35% owned by Dutch bank, Rabobank.

8.4 POTENTIAL BENEFITS OF EBANKING TO LIBERIA

The African Development Bank is currently financing a project to integrate the Liberian Central Bank into the regional banking community in West Africa. The project will provide protocols and equipment, and implements recommendations by USAID to the Central Bank of Liberia. It is also likely that foreign banking solutions and products such as those offered by Nokia or Standard Bank in South Africa could be enticed to Liberia. In addition to the above factors, the National Bank of Liberia is proposing to launch an ePayments capability in 2010, which has been long awaited by Liberian banks and would support electronic payments of salaries, bills and other services. GoL's requirement to pay salaries to employees can be used to seed this ePayments system.

ePayments systems would provide numerous tangible and intangible benefits to Liberians including:

- lowers transaction costs by bypassing traditional modes of transaction;
- reduces opportunity for waste, abuse, and fraud due to account verification process and reduced need for paymasters in direct deposits;
- encourages local economy by keeping money in the community;
- may reduce the cost of maintaining saving accounts for Liberian citizens due to lack of need for physical bank branches.
- provides families with a safe way to build financial cushions that may be used to survive unexpected events and to build assets.
- reduced travel time to collect the pay checks results in fewer days away from employment; and
- improved perception of government efficiency by employees for example due to automatic notification of employees via their mobile phones upon deposit of paycheques into their accounts.

In addition, the potential benefits of mobile banking to Liberia are numerous:

- Provides a mechanism for rural and urban inhabitants to safely and inexpensively save and transport cash, without lengthy travels, resulting in fewer losses due to theft.
- Makes it possible for citizens to more easily transfer money safely and conveniently to intended beneficiaries, including those living in remote rural areas
- Provides an improved mechanism for government to make payments and transfers to citizens, such as the civil service payroll and social grants
- Improves the access of unbanked citizens to financial services
- Offers an inexpensive vehicle for remittances from Monrovia and abroad directly to rural areas. Demand for this service will in turn provide telecom operators with the commercial incentive to build infrastructure in rural areas which eGovernment requires.
- Provide rural jobs for eBanking dealers who are quasi bankers in their villages, making micro-loans.
- Provide a low cost platform which can be expected to encourage donors such as UNICEF to implement social schemes, as the cost of implementation is likely to be substantially reduced. UNICEF is currently conducting a pilot project on social transfers from GoL. If shared platforms were in place, the low cost would encourage other social transfers to be put into place in a ``Build it and they will come`` approach.

- Allows capture of remittance payments to urban and rural residents into the deposit network (which can be recirculated back into the economy as loans) rather than simply being used for current consumption. As customers become accustomed to the concept of saving on their mobile account, they are more likely to develop a credit record, which would allow them to qualify for loans (to start businesses) and may even “graduate” to full bank accounts and other financial products such as insurance.
- Enable access to mobile financial services such as transfers for food, shopping or to send money home (where this is elsewhere or distant) and provides a mechanism to save cash.

8.5 RECOMMENDATIONS:

Specific measures must be taken to encourage the rapid growth of mobile banking (or eBanking) in Liberia, recognizing the substantial benefits that mobile banking has brought in other countries by “banking the rural poor”. We have outlined below some of the steps that would be appropriate. We recommend that mobile banking be pursued in order to fully exploit the capacity of ACE, encourage investment and banking formally within the unbanked public, and increase the basket of services offered by mobile operators with a view to increasing consumer confidence and competition in the sector:

- **Create a supportive legislative and regulatory environment for eBanking and eCommerce.** This framework should conform to international standards with an appropriate AML/CFT roadmap, in order to ensure a viable and competitive landscape while safeguarding consumers’ rights and protections as well as the stability of the financial market. GoL must develop and adopt legislation and regulations supportive of eCommerce and eBanking including ePrivacy, eSignature, eEncryption and other eCommerce-related laws.
- **Provide leadership to educate stakeholders including consumers.** All stakeholders must understand and accept their functions, and to achieve a broad-based commitment from all actors to the emergence of the new services. A major drive to educate the population about the benefits of banking and the ease and convenience of mobile banking will be required, and should be led by GoL, mobile operators and banks.
- **Design monitoring systems to improve knowledge of mobile-money transactions, and to provide necessary feedback loops into the regulatory and policy arenas.**
- **Conduct an early pilot of a mobile-money transfer scheme to government employees located in less-remote rural areas.** This will help GOL to safely better understand the benefits and challenges of such systems in the Liberian context, enabling it to learn and adapt the framework, while also signalling to stakeholders its commitment supporting the development of the new services.
- **Encourage partnerships by Liberian telecom operators and Liberian banks.** A key catalyst for such partnerships is to create the regulatory framework required to license or register non banking institutions such as telecom operators to act as agents for banks. The Central Bank of Liberia should develop and adopt guidelines on agent banking, which authorize commercial banks and financial institutions to hire non banking institutions such as mobile telephone companies as their agents, which will support the rapid rollout of mobile money transfer commerce in Liberia as mobile operators already have extensive rural dealer / kiosk networks. The Central Bank of Kenya is expected to release such guidelines in Kenya shortly, and these could be used as a basis for Liberia’s work. This regulatory regime should include capital requirements for applicants, application submission, approvals and other necessary information. The process to develop the guidelines should be transparent in order to ensure that the many smaller more marginal Liberian money transfer service providers are aware of the opportunity to obtain a license and the obligations, if they wish to continue to provide money transfer services. All related decisions, forms and opportunities to provide input

should be made available online since it is easily accessible and should serve as a formal channel of stakeholders' engagement.

- **Require each bank to link branches to an internal electronic network via secure internet.** In order to facilitate reporting and account management, all Liberian banks should link all branches to an internet-based electronic network.
- **Adopt Agent Banking regulations or guidelines.** These will facilitate the regulation of retailers who would act as banking agents for the mobile banking services. Existing small retailers in Liberia who already sell mobile-phone airtime in the form of scratch cards, must register as mobile-money agents, so that they can accept and pay out cash from customers³⁸.
- **Associated regulatory changes needed.** LTA will need to enforce facilities-leasing and access regulations to enable mobile operators to access Libtelco's duct system (and in general). GoL may need to revisit the rules regarding the establishment of banks and particularly foreign banks in Liberia, and the restrictions on lending and capital.
- **Encourage and support operators.** Pilots by other mobile operators should be encouraged and any obstacles encountered by them or Lonestar in its existing pilot should be identified and if possible, removed or the effects mitigated.

³⁸ By way of example, in Kenya there are more than 17,600 such retailers out of about 100,000 registered as M-PESA agents, compared to only 840 bank branches in Kenya. Safaricom customers with a mobile money account in M-PESA exchange real cash for "e-float" in his account in the M-PESA network. The customer can transfer his e-float to other customers using his mobile phone, and also trade in the e-float for cash at any of the M-PESA agents. The Economist: Economist Intelligence Unit - Executive Briefing. Banking on mobile phones: Out of thin air. The behind-the-scenes logistics of Kenya's mobile-money miracle. June 14, 2010

9 RECOMMENDATIONS TO BRIDGE URBAN–RURAL DIVIDE

9.1 STRATEGY

This section provides a proposed strategy to help bridge the urban – rural divide within Liberia by facilitating rural connectivity and development. This strategy for the communications sector incorporates two components:

- long term vision for access; and
- short term goals leading to the achievement of that vision.

This proposed strategy provides **a framework for a long-term vision of access, aligned with shorter-term goals and objectives over the next 3-5 years**. The strategy considers the current status of access in Liberia as well as the plans to focus on the development of the national fiber backbone infrastructure along the Liberian development corridors for the next 5 years.

The focus of this strategy will be on the development and implementation of a series of **pilot projects** within each of the strategic objectives and program areas. These projects will be implemented in rural and under-served or un-served areas only, with special consideration to those areas with high population density (e.g., the North East part of the country) and not reached by the plans to extend the fiber/broadband backbone along the development corridors. However, it will be critical to ensure that some infrastructure is available and that connectivity is a possibility, not just through current and planned infrastructure, but through new access options such as those provided by O3b or other wireless options provided by operators, such as WiMAX.

This strategy should form part of the national universal access strategy being developed by GoL with the LTA and administrators of the Universal Access Fund. Universal access is defined in the 2007 Act as set out in the introduction to this report, but we have focused on achieving rollout of and access to capacity on the ACE cable. This strategy ensures that infrastructure will be in place to deploy access further into un-served areas

9.2 ASSUMPTIONS AND BELIEFS

This proposed strategy is based on **two important assumptions**:

1. That the Universal Access/Service Fund will be established and become operational in 2010; and
2. That there will be sufficient infrastructure in specific rural areas to allow for the implementation of the proposed Action Plan.

If the above assumptions are not met, the GoL will not be in a position to meet its goal of bridging the urban-rural divide, particularly to provide access in areas currently un-served and/or far too remote for operators to reach.

The resulting action plan (see below) is developed considering key goals for the new Fund's board and focuses on the implementation of pilot projects in this first phase of the Fund's operations. This approach allows the Fund to start implementing this strategy while using the process as a learning and capacity building experience. The recommendation to focus on pilot project implementation in the first 3-5 years of the Fund's operations is based on the following beliefs:

- The implementation of pilot projects will allow the Fund to test the demand for and infrastructure for ICT access in rural areas.

- This strategy is developed to create a built-in capacity building program for the implementing agency, as it needs to gain experience on a complex set of tasks and responsibilities, including strategic planning, project development and design, the development of terms of reference, bidding processes, collaboration among entities, implementation and evaluation of projects and programs, active involvement in demand stimulation projects, among others responsibilities.
- Pilot projects provide a platform to test and assess different approaches to project implementation, such as PPPs, and determine their value moving forward. One such project could evaluate the six Learning Resource Centres (telecentres) in rural areas which were recently passed to GoL.
- After a 3-5 year period, with the accumulated experience from the pilot projects and a large percentage of the backbone infrastructure in place, including efficient connectivity to ACE capacity, the Fund will be better positioned to develop and plan rural projects that take full advantage of the available capacity and will better respond to the ICT needs of rural populations

9.3 IMPLEMENTATION

This universal access strategy should be implemented through a logical sequence of steps and projects, implemented through the 3-5 year period, while building on each other's operational experiences, the accumulated capacity of the Fund's staff, and on the infrastructure available. This approach suggests that a small number of pilot internet access centers be implemented in the first year of the Fund's operations and that additional projects be implemented once these are able to provide the necessary access and infrastructure to support the implementation of additional projects, such as an ICT capacity building project or a School connectivity project.

Critical to this approach is the opportunity to develop and strengthen collaboration and partnership among stakeholders and users so that the benefits of ICT access in rural areas is maximized. In addition, and to ensure the success of the program, the Fund should work closely with the LTA and other stakeholders, such as the ICT4D Steering Committee, to implement a series of demand-stimulation measures which are considered in more detail below.

This rural development strategy needs to be revised in about 3-4 years and updated to reflect developments in the sector, lessons learned from the proposed program (through the on-going evaluation of projects), and the experience and capacity of the agency implementing the program.

9.4 OBJECTIVES

The following table provides the proposed objectives to facilitate rural development in Liberia in the next 5 years. These objectives form the basis for the proposed Action Plan under this strategy (see Table below for details). These objectives may be extended, revised or changed when the universal access strategy is revised in 3-4 years (in preparation for a new 5-year period). Objectives should reflect developments in the sector as well as lessons learned through the implementation of the strategic plan. For additional details on the objectives, cross-cutting themes and principles please refer to Appendix 7.

Figure 20. Proposed Objectives for Rural Development

**Universal Access Strategy for Liberia:
Strategic Objectives for Rural Development**

Expand rural telecommunications infrastructure and access to rural areas of Liberia, with a focus on public shared access to multipurpose ICT facilities.

Collaborate with other sectors to develop critical infrastructure (electricity, roads) in rural areas of Liberia necessary to support telecommunications operations and affordable internet access.

Provide Connectivity to Public Institutions in rural areas.

Provide Educational Opportunities in ICT through a Rural Education and Capacity Building Program.

Support the Development of Content and Applications through a Content and Applications Program.

Promote and facilitate the establishment of Public-Private Partnerships in the implementation of rural projects.

Develop a program to identify ICT Champions with the responsibility of increasing awareness and promote the use of ICT in the development of Liberia.

Note: For further detail please see Appendix 7.

10 ACTION IMPLEMENTATION PLAN

This report provides a detailed Action Implementation Plan (Action Plan) in Appendix 1, which includes:

- specific tasks;
- a responsibility matrix;
- an outline implementation schedule; and
- some measurement parameters for the key steps to successfully distribute high speed internet access across Liberia.

11 PRELIMINARY RAPID ASSESSMENT OF ACE CABLE CONSORTIUM PARTICIPATION

Overview

On March 24, 2010, the Consultants submitted a report to IBI International entitled Rapid Assessment of ACE Cable Consortium Participation (the Rapid Assessment Report). That report was used by GoL and World Bank in their analysis to evaluate whether to support participation by Liberia in ACE. This Chapter summarizes the Rapid Assessment Report, in order to provide context for the other conclusions reached in the Fast Track Action Plan Report. Readers are referred to Appendix 9 of this report and the full Rapid Assessment Report for additional details.

The Rapid Assessment Report was completed on an expedited basis due to the timeline for decisions required by GoL and LTA to participate in ACE submarine cable. In the Rapid Assessment Report we considered at a high level, because of the limited time available:

- The current status of the ACE cable
- The technical characteristics of the cable
- The options available for structuring Liberia's participation in the cable consortium
- A preliminary financial assessment
- Other options for international connectivity available at present
- An appropriate regulatory framework to be implemented by LTA

Although a number of other alternatives are also available to Liberia to obtain international connectivity, our preliminary assessment indicated that from a timing and availability point of view, full membership in ACE can provide low cost international access to a broad range of Liberians, if accompanied by robust regulation by LTA to ensure competitive pricing releases demand. We highlighted the risks involved in this venture in the Rapid Assessment report. However, we note that virtually any alternative to obtain high capacity international broadband backbone access for Liberia would involve substantial risks. The appendices to the Rapid Assessment Report includes a detailed review of alternatives to ACE to obtain international connectivity.

The conclusions of the Rapid Assessment Report are summarized below. Please see Appendix 9 of this report for the full text of the Rapid Assessment Report (however we have not included in this report the appendices to the Rapid Assessment Report).

Status of the ACE Cable

The Government of Liberia (GoL), Libtelco and the Liberian Telecommunications Authority (LTA) have indicated firm interest in France Telecom's Africa Coast to Europe (ACE) submarine cable. Members are due to meet on March 27 to indicate their firm commitment, sign ACE documentation and provide evidence of their ability to fund their participation. Suppliers have been in negotiations with members of the ACE consortium, and technical, financial and commercial information has been shared with members. Libtelco has already signed a preliminary commitment to ACE by concluding an Additional Party Memorandum of Understanding and paying an amount of USD40,000 to secure Liberia's participation.

The technical design

The cable design is both "state of the art" and proven, and involves no significant technology risk. The choice of SDH electronics is conservative and has reasonable efficiencies carrying Internet Protocol (IP)

traffic. The cable route is relatively well known and at least some initial marine survey work appears to have been undertaken. There are a number of points to note regarding capacity which we have outlined in Annexure 2 in more detail. Given the technology, design and experience of the contractors, the implementation risk is minimal. There is a risk of cable breaks on the operational system. Although good design, including the cable route, cable landing points and landing construction, can mitigate risk, the probability of a break at some time during the design life is non-zero.

Options on Structuring

There are two potential ownership structures for membership of ACE and ownership and operation of the landing point in Liberia:

- Commercial consortium of Liberian operators; or
- A special purpose vehicle (SPV) structure which would initially include GoL as represented by Ministry of Finance, funded by one or more international financial institutions (IFIs).

We have considered both options and concluded (in part given the advanced stage of negotiations by the operators) that a commercial consortium is optimal in the circumstances. More detail is included in the final appendix

Return on Investment

In drafting this Report, we conducted a preliminary analysis of the market for international access, focusing on Internet and IP network traffic, in Liberia taking into account the costs associated with ACE and possible wholesale prices for international access. Our preliminary financial calculations indicate that this investment would have a project net present value (NPV) of approximately of \$21 million over 15 years with a 15% discount rate, breakeven payback should occur in year 10, and an internal rate of return (IRR) is estimated of about 22% (based on specific assumptions noted in the model). The final appendix contains additional information.

An Appropriate Regulatory Framework

The owners of ACE in Liberia will hold a monopoly over the cable and its capacity. In order to ensure that both wholesale and retail pricing is reasonable, and that terms of access to the cable and associated facilities are non-discriminatory and fair, LTA will need to implement a strict access and pricing framework. We have considered the issues and suggested next steps for LTA to implement this framework in the final appendix.

APPENDIX 1: ACTION PLAN

Actions to Implement Infrastructure Build-Out—Chapter 2, 3, 4 and Technical Strategy Appendix:						
Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
To provide broadband connectivity to the county capitals.	County backbone network.	Universal Access Fund, ICT 4D Committee, or Ministry of Planning and Economic Development	To be determined	2010	(1) Create a suitable PPP vehicle to provide the county broadband network (e.g., similar to the CCL for ACE). Could possibly be CCL	Creation of the SPV or revised scope of the CCL.
		Universal Access Fund, ICT 4D Committee, or Ministry of Planning and Economic Development		2010-2011	(2) Identify and implement any necessary incentives to create near and medium term viability, for both the PPP and to motivate individual operators to exploit their existing terrestrial microwave routes.	Identification of incentives. Implementation of recommended incentives.
		The selected operating entity	To be determined.	2011	(3) Through the PPP, consider an UNMIL based microwave solution in the near term, and consider an O3b solution to the county capitals for the post 2012 time-frame.	Feasibility study and development of a project definition. Securing funding.
			To be determined by the feasibility study (this Plan provides indicative investment levels)	2011-2020	(4) Through the PPP, plan a phased deployment of a national fiber-optic network to all county capitals, and construct this network in phases, possibly funded in part by GoL proceeds of sale to other operators of its participation in CCL prior to launch of ACE service.	Implementation of the plan.

Actions to Implement Infrastructure Build-Out—Chapter 2, 3, 4 and Technical Strategy Appendix:

Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
To provide broadband connectivity to the rural areas outside the county capitals.	Rural access networks	Universal Access Fund	To be determined	2011	(1) Form a set of logical county groupings that may be tendered on a minimum subsidy basis to private sector operators for the construction of rural networks and provision of broadband rural.	
		ICT4D committee, Universal Access Fund	To be determined	After the county capitals are connected and as funding becomes available.	(2) As county capital connectivity is established, decide on the preferred timing and/or priority for tendering.	
		Universal Access Fund	To be determined by a competitive bidding process (this Plan provides indicative investment levels).		(3) Tender each area to the private sector on a minimum subsidy basis.	Implementation of the plan.

Chapter 5: Potential Funding Sources

Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
Contribute to Universal Access Fund (UA Fund) for purposes of funding infrastructure rollout to counties and rural communities Increasing the UA Fund		ICT4D, UA Fund, LTA, Ministry of Communications, Ministry of Finance, Direct Funds Committee, environmental committees		<p>2-3 years</p> <p>5-year plan to be established</p> <p>All agencies and Ministries have committed to implementing appropriate regulations and laws within a specific period (no more than 3 years)</p> <p>All projects have been identified over a 5-year period</p> <p>All agencies have agreed level of contribution and circumstances of contribution</p> <p>Mechanisms have been identified for contribution and payment to communities/projects</p>	<p>Liaison between all interested parties (ICT4D to lead)</p> <p>Programme to be agreed between all parties as to regulations required or similar to require contributions</p> <p>Community Development Funding: contributions must be agreed and mechanisms established for payments to communities affected by infrastructure projects</p> <p>All projects being rolled out in any sector with an effect on communities to be identified</p>	Regulatory framework is in place, laws and/or regulations in place across sectors, implementation is effective and monitored, communities are sensitized to the issue and can make representations
		LTA, Ministry, ICT4D		<p>2-3 years</p> <p>UA Fund is in place, procedure for funding and identification of projects is in place, procedure for allocating funds is in place</p>	Establishing UA Fund and procedures	Fund is up and running, financial statements are published, reports are published annually indicating what monies have been received, projects identified and funds paid out
		GoL, LTA, Ministry of Finance	USD5 million	<p>End of 2012 or prior to launch of ACE</p> <p>GoL pays funds to UA Fund</p>	Divestment of GoL stake in CCL, identify purchaser, negotiate sale price, agree purchaser with CCL, amend agreements, conclude transaction	GoL divests itself of its stake in CCL and pays contribution into the UA Fund

Chapter 5: Potential Funding Sources						
Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
		Relevant Ministries for foreign affairs, Ministry of Communications, UA Fund, LTA, ICT4D	Per budget for UA Fund and/or budget for rural connectivity program	1-2 years Approach ECOWAS Bank for Investment and Development to obtain funding for rural connectivity	ECOWAS Bank investment	ECOWAS approached for loan, ECOWAS criteria satisfied, ECOWAS Bank approves loan, loan paid to project fund/UA Fund
		LTA, UA Fund	Contributions from operators	1-2 years LTA to put UA Fund regulations in place to require contributions from licensees annually Licensees to pay to UA Fund according to policy and regulations	LTA to put in place regulatory regime for contributions by licensees to UA Fund	LTA drafts and consults on regulatory regime for contributions to UA Fund according to Policy and 2007 Act LTA finalises and implements regulations with a lag time (say 1 year) LTA regulations require contributions to fund

Chapter 6: Legal and Regulatory Component and related activities						
Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
Publish a regulation to establish the Universal Access Fund	LTA function	LTA	LTA budget or donor funding	LTA to consult broadly with industry regarding appropriate investment for funds, application, methodology for allocation, tender processes, criteria for selection and award. Consultation and drafting to take 6-12 months.	Consultation, drafting, further consultation and final regulation to be published and implemented Establish Fund Accept payments Identify projects in consultation Conduct tenders	Award of subsidies.

Chapter 6: Legal and Regulatory Component and related activities

Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
Establish a regulatory regime for ACE capacity, access, distribution and pricing	LTA function	LTA	LTA budget or donor funding	<p>LTA to publish regulation and require contributions from operators (within lengthy lead time, following end of following financial year for example)</p> <p>Prepare a licence for CCL, consult, award the licence.</p> <p>Determine “dominance” under the 2007 Act and consult on appropriate conditions to be triggered by a dominance finding</p> <p>Investigate prices to be charged for access to infrastructure and capacity, resale terms (wholesale and retail terms)</p> <p>Determine if price control is appropriate and impose price control regime at wholesale and/or retail level</p> <p>Enforce access through interconnection and facilities-leasing regulations, apply a RIO</p>	Consult, draft, implement	CCL is licensed and declared dominant, price control regime applies
Introduce mobile banking	Mobile banking programme	GoL and ministries eg Justice, Finance, Communications	Unknown	Consult, assess, prepare laws, amend laws, implement – this process is likely to take up to 3 years	<p>Analyse existing laws to determine where they may require improvement or refinement or if new laws are required eg to establish agents, adopt legislation and regulations supportive of eCommerce and eBanking including ePrivacy, eSignature, eEncryption and other eCommerce-related laws</p> <p>Facilitate negotiations between banks, GoL, operators and LTA</p>	<p>Need is determined and defined</p> <p>Laws are amended and introduced</p> <p>Some initiatives have begun to raise awareness</p>

Chapter 6: Legal and Regulatory Component and related activities

Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
					<p>Review practical impediments to mobile banking, education or raising awareness initiatives will be required. A major drive to educate the population about the benefits of banking and the ease and convenience of mobile banking will be required, and should emanate from GoL.</p> <p>Encourage partnerships by Liberian telecom operators and Liberian banks</p> <p>All Liberian banks should link all branches to an internet-based electronic network.</p> <p>Adopt Agent Banking regulations or guidelines</p> <p>LTA will need to enforce facilities-leasing and access regulations to enable mobile operators to access Libtelco's duct system (and in general).</p> <p>GoL should revisit the rules regarding the establishment of banks and particularly foreign banks in Liberia, and the restrictions on lending and capital.</p> <p>Pilots by other mobile operators should be encouraged and any obstacles encountered by them or Lonestar in its existing pilot should be identified and if possible, removed or the effects mitigated.</p> <p>Expedite Central Bank of Liberia epayments system.</p>	

Chapter 7: Institutional Regulatory and Commercial Constraints to Infrastructure Development

Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
Remove constraints on investment in rural broadband initiatives	Rural broadband connectivity	LTA, Ministry of Communications, Ministry of Justice, Ministry of Finance, ICT4D	Unknown	2-3 years Create regulatory uncertainty to encourage investment	Develop clear regulatory regime, finalise outstanding regulations as above, establish a body of precedent by making similar decisions in similar circumstances, implement regulations consistently and transparently	Regulations are published More precedents are created Sector participants become familiar with regulations and fewer disputes result Investors and potential investors have fewer queries or concerns
	Finalise licence fee regime			1 year LTA finalises licence fee regulations in accordance with international best practice	LTA drafts and consults on licence fee regulations, LTA finalises licence fee regulation, LTA implements regulation with a time lag, say 1 year, licensees make payments	Regulations are finalized Licensees make payments
	Amend 2007 Act			1-2 years 2007 Act amended so as to remove or amend reference to National Operator	LTA drafts a proposal to Ministry of Justice to amend the 2007 Act so as to remove or amend the reference to National Operator as Libtelco and require NO to comply with obligations in this regard	LTA submits proposal to Ministry Ministry approves proposal Libtelco is no longer NO NO provisions in 2007 Act either deleted or obligations defined and limited for NO's
	Customs duties	Ministry of Finance, Customs, LTA		1 year Customs duties on telecoms and IT equipment moratorium for limited period of time put in place	LTA provides importers with certification of equipment to be imported, and inspects equipment at customs Customs publishes a moratorium of certain duties on imports provided a certificate from LTA is produced and inspection takes place	LTA invites licensees to submit list of equipment that has high duties LTA liaises with customs LTA defines equipment that is proposed to be subject to moratorium Customs agrees

Chapter 7: Institutional Regulatory and Commercial Constraints to Infrastructure Development

Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
	Licensing of minor operators	LTA, Ministry of Communications and Justice		1-3 years LTA puts in place a light touch regulatory regime for minor operators	LTA consults with operators and interested parties on a class and individual licensing regime to advance light touch regulation and remove licensing as a barrier to rolling out services or smaller networks in rural areas and counties, and to increase competition so as to drive prices down for certain services LTA formulates a list of activities that could be licensed by class licences LTA proposes a regulation in this regard	LTA receives submissions on relevant activities LTA meets with Ministry to discuss relevant changes to regulations and licence conditions

Chapter 8: Mobile Banking

Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
Develop a program to test market demand and supply for m-banking services in Liberia	m-banking pilot program	Ministry of Communications operators, UAF, ICT Steering Committee	\$100K for pilot research and test	Facilitate and support a research, market analysis, and testing project to determine the potential for m-banking services in rural Liberia. This should take place in the 3 rd year of the Plan	Develop terms of reference and implement the project.	Study results, prepare changes to laws and new draft laws if appropriate
Create a supportive legislative and regulatory environment for eBanking and eCommerce.				<p>This framework should conform to international standards with an appropriate AML/CFT roadmap, in order to ensure a viable and competitive landscape while safeguarding consumers' rights and protections as well as the stability of the financial market. GoL must develop and adopt legislation and regulations supportive of eCommerce and eBanking including ePrivacy, eSignature, eEncryption and other eCommerce-related laws.</p> <p>LTA will need to enforce facilities-leasing and access regulations to enable mobile operators to access Libtelco's duct system (and in general). GoL may need to revisit the rules regarding the establishment of banks and particularly foreign banks in Liberia, and the restrictions on lending and capital.</p>		
Provide leadership to educate stakeholders including consumers				All stakeholders must understand and accept their functions, and to achieve a broad-based commitment from all actors to the emergence of the new services. A major drive to educate the population about the benefits of banking and the ease and convenience of mobile banking will be required, and		

Chapter 8: Mobile Banking						
Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
				should be led by GoL, mobile operators and banks.		
Design monitoring systems to improve knowledge of mobile-money transactions, and to provide necessary feedback loops into the regulatory and policy arenas						
Encourage partnerships by Liberian telecom operators and Liberian banks				<p>A key catalyst for such partnerships is to create the regulatory framework required to license or register non banking institutions such as telecom operators to act as agents for banks. The Central Bank of Liberia should develop and adopt guidelines on agent banking, which authorize commercial banks and financial institutions to hire non banking institutions such as mobile telephone companies as their agents, which will support the rapid rollout of mobile money transfer commerce in Liberia as mobile operators already have extensive rural dealer / kiosk networks. The Central Bank of Kenya is expected to release such guidelines in Kenya shortly, and these could be used as a basis for Liberia's work. This regulatory regime should include capital requirements for applicants, application submission, approvals and other necessary information. The process to develop the guidelines should be</p>		

Chapter 8: Mobile Banking						
Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
				transparent in order to ensure that the many smaller more marginal Liberian money transfer service providers are aware of the opportunity to obtain a license and the obligations, if they wish to continue to provide money transfer services. All related decisions, forms and opportunities to provide input should be made available online since it is easily accessible and should serve as a formal channel of stakeholders' engagement.		
Require each bank to link branches to an internal electronic network via secure internet.				In order to facilitate reporting and account management, all Liberian banks should link all branches to an internet-based electronic network.		
Adopt Agent Banking regulations or guidelines				These will facilitate the regulation of retailers who would act as banking agents for the mobile banking services. Existing small retailers in Liberia who already sell mobile-phone airtime in the form of scratch cards, must register as mobile-money agents, so that they can accept and pay out cash from customers		
Encourage and support operators				Pilots by other mobile operators should be encouraged and any obstacles encountered by them or Lonestar in its existing pilot should be identified and if possible, removed or the effects mitigated.		

Chapter 9: Actions to Bridge the Urban-Rural Divide (Rural Development)
Rural Development Component

Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
Provide universal access consisting in public shared access to multipurpose ICT facilities in rural areas	Multipurpose Public Access Centers (MPACs) Program	Universal Access/Service Fund (UAF)	\$600K/year	Based on the market and sector analysis to be conducted, agree on a number of localities to provide access to for each operating period until 2015 (it should include at least 4 localities per year , depending on districts)	MPACs in “access gap” areas, where MPACs can be sustainable MPACs in non-sustainable areas, where subsidies are required for the long-term	Number of MPACs implemented by geographic area Number of MPACs with proper access to ICTs Number of MPACs providing support to public institutions, such as schools, health centers
Collaborate with other infrastructure providers to ensure efficient deployment of mutually beneficial infrastructure	Joint telecom and electricity deployment program	Ministry of Planning, Ministry of Communications and Transport, Ministry of Energy	N/A	Ensure that all infrastructure plans in rural areas are coordinated between Ministries/agencies to maximize deployment opportunities and share costs. This should happen throughout the year .	Infrastructure Coordination Committee for Rural Development	Number of joint projects with telecom and electricity sector operators
Provide connectivity to public institutions in rural areas	Connectivity to Public Institutions Program	Ministry of Health, ICT Steering Committee, Ministry of Communications and Planning	\$150K/year	Provide connectivity to public institutions in localities where MPACs and other UA projects are implemented. This should take place 6 months after each public access project is implemented , starting in the second year of the Fund and ongoing after that.	Connectivity to educational institutions: to ensure that they have access to the appropriate ICT tools for their specific needs, including school-based telecenters. Connectivity to health institutions: to ensure that they have access to the appropriate ICT tools to meet their communication and information/education needs.	Key education and health care institutions have proper connectivity to ICTs Type and quality of services provided because of access to ICTs at the institution
To support the development	Content and Applications	ICT Commission,	\$150K per year	To support the development of local	Promote content competitions, e.g., best village or district	Participation in contest

Chapter 9: Actions to Bridge the Urban-Rural Divide (Rural Development)
Rural Development Component

Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
of content and applications	Program	University program		content and applications for at least half of the localities where MPACs and other UA projects are implemented. This should include one content competition per year , as well as an on-going effort to improve local education and liaise with private institutions.	website Contest Local content development program (in collaboration with existing initiatives and education institutions)	Websites or web-based information content developed by trainees
Promote the opportunity and establishment of PPP for the implementation of universal access projects at all program levels	PPP Program	Chambers of Commerce, Business Associations, Ministry of Planning	\$25K/year	To facilitate and support the establishment of PPP in the implementation of universal access projects within each program area. Conduct 1 workshop per locality per year , where UA projects are implemented.	Develop PPP workshops to introduce stakeholders to the concept, to potential partners, and to the UAF.	PPPs established for rural development projects
Develop a program to identify ICT Champions in Liberia	ICT Champions Program	UAF, ICT Steering Committee	\$50K/year	Identify 2-3 national ICT Champions per year to participate in raising awareness and ICT sector promotion activities. Program should start in the second year of implementation.	Each year, identify 2-3 national ICT champions (selected by the public and sector). Each Champion should be available to conduct special activities for awareness and sector promotion, at least twice a year. Develop campaign to raise awareness in collaboration with sector stakeholders.	Public events featuring ICT Champions. Pamphlets, videos, and participation in ICT sector awareness campaigns.
Conclude concession	Enabling Concessions	Relevant Ministries, UA	Unknown	Prepare report within 1st year. At the same time	Report on existing projects with spare fiber or available ducts or	Identify concessions that might be appropriate,

Chapter 9: Actions to Bridge the Urban-Rural Divide (Rural Development)
Rural Development Component

Objectives	Program	Responsible Agency	Budget	Targets and Time Frame	Projects (proposed projects to be discussed and approved)	Sample Indicators
agreements with other infrastructure providers		Fund, ICT Steering Committee, WAPP		and into 2 nd year facilitate negotiations to finalise arrangements. Involve operators, get support from investors of those projects. Approach WAPP with a view to co-ordinating regional initiatives.	infrastructure (power lines) and projects in the pipeline that might be suitable for joint concessions. Liaise with investors on those projects. WAPP-related initiatives to be pursued.	approach investors and concessionaires, liaise with operators, conclude agreements, and finalise arrangements with WAPP.

APPENDIX 2: BACKGROUND

1. ACE SUBMARINE CABLE LANDING INITIATIVE

The Africa Coast to Europe (ACE) submarine cable system extends 14,000 km from Penmarch in France to Cape Town in South Africa. GoL initiated participation in the ACE submarine cable through the efforts of Libtelco which is a state-owned enterprise. We understand that Liberian operators including Libtelco and LTA signed a Memorandum of Understanding (MoU) with LTA confirming the operators' commitment to hold the Liberian membership in ACE in a company in which they would each hold shares, and committing LTA to the development of a non-discriminatory regulatory framework for cable landing stations and access to and distribution of broadband capacity in Liberia. The Cable Consortium of Liberia (CCL) was formed by Liberian operators to finance, own and manage the Liberian components of the landing point in Monrovia and is the Liberian representative in the ACE consortium. Funding of the landing point will be provided by Cellcom, Lonestar, and the Ministry of Finance through Libtelco. The ACE Construction and Maintenance Agreement (C&MA) was signed by Liberia's representatives in June 2010.

High speed international broadband access is currently available only to limited echelon of Liberians, NGOs, larger businesses, GoL entities and others who obtain international access at very high cost via VSAT service. The Government of Liberia (GoL) Liberia Telecommunications Authority (LTA) and operators including Liberia Telecommunications Corporation (Libtelco) have demonstrated their commitment to participating in ACE submarine cable by forming CCL and negotiating amongst themselves regarding their likely business plans and funding arrangements.

ACE service is expected to be launched in late 2012, if the proposed construction schedule is met. However, the benefits of high speed international broadband access that ACE has the potential to provide to Liberians will be limited unless steps are taken quickly to prepare Liberia and Liberians to use this to full potential. In essence, there are two phases to ensure that Liberia obtains international broadband access:

- Phase I: bring ACE or other international connectivity option onstream
- Phase II: ensure this access reaches a broad population of Liberians at sufficiently low cost to encourage broad use and participation in the global information society.

2. BENEFITS OF ICT ACCESS FOR DEVELOPMENT IN LIBERIA

The following chart indicates that every 10% increase in broadband penetration could increase GDP growth in developing countries by 1.38%.³⁹ The low-cost broadband connectivity provided by ACE will encourage substantially higher broadband penetration in Liberia, thereby increasing GDP growth. Research further indicates that the number of households internationally with broadband increased by 18% in 2008, despite the global recession,⁴⁰ so the status quo will not remain static if Liberia fails to increase broadband penetration – and Liberia is likely to fall behind its neighbors.

³⁹ Source: "Information and Communication for Development Report 2009", World Bank (2009).
⁴⁰ Park Associates, United States.

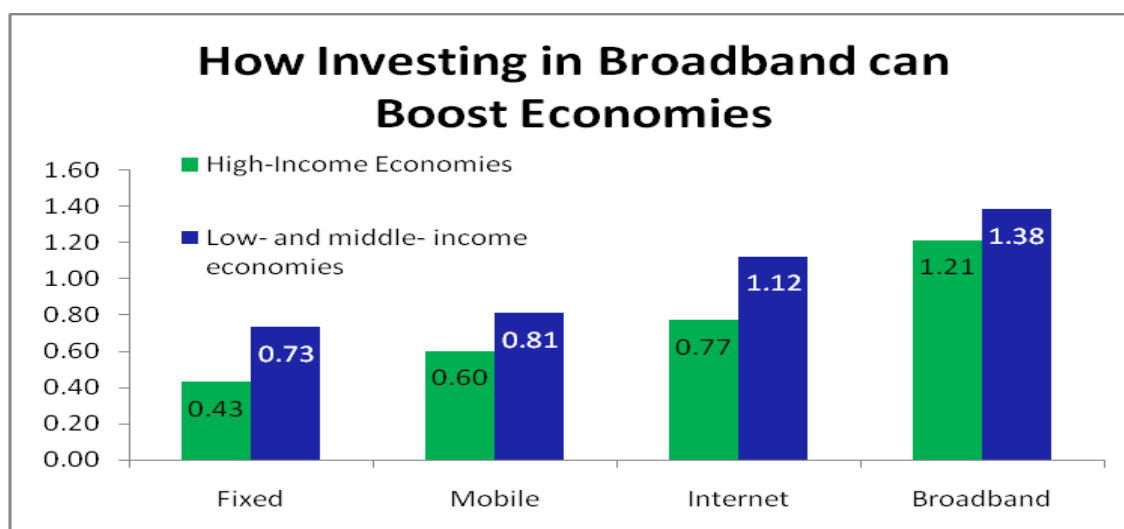


Figure 21. Economic Effects of Broadband

The following chart notes that secondary investments driven by broadband may be ten times the initial investment, while their contributions to GDP could be 15 times higher.

<i>The Multiplier Effects of Investments in Broadband Infrastructure (the United Kingdom and Canada)</i>		
	United Kingdom*	Canada**
	Investment in community broadband infrastructure	Investment in e-learning, telemedicine and broadband
Initial investment by government in broadband infrastructure	USD 10 million	USD 10 million
Leveraged investment from other sources (private sector, municipal authorities, etc.)	USD 116 million	USD 101 million
Total Investment	USD 126 million	USD 111 million
Contribution to GDP from total investment	USD 164 million	USD 150 million
Contribution to total employment	2100 jobs	4800 jobs
Contribution to taxes	USD 61 million	USD 32 million

Source: Strategic Networks Group (SNG)

* SNG report for UK Department of Trade and Industry, 2003

** SNG report for Industry Canada, 2004

Figure 22. Multiplier Effects of Investments in Broadband Infrastructure

An example of the transformative role that ACE cable can play as a catalyst for broader growth in Liberia is in the Liberian banking sector. Liberian banks would benefit from the low cost bandwidth, which they could leverage to support new Monrovia and rural customers, and services such as eBanking and online services, ePayments, ATMs, and credit cards, as well as services in new geographic markets. Banks would also benefit from any follow-on investment in Monrovia and rural Fiber Optic Backbone, packet based next-generation network technology, both by lending at a profit to operators who build these networks and also by using the new infrastructure to support expanded banking services at lower cost.

3. COSTS TO LIBERIA OF NOT PARTICIPATING IN ACE

As the following map indicates, many West African countries already have broadband international connectivity via the SAT-3 cable including Ivory Coast and Senegal. Senegal will obtain secondary connectivity via Main One cable and Ivory Coast via WACS cable, which is currently being constructed. Liberia is one of several West African countries without broadband international connectivity (along with Sierra Leone, Guinea, Guinea-Bissau, and The Gambia). This lack constrains growth within the Liberian telecommunications sector and the broader economy, where telecom investment has been confirmed to be a catalyst for growth.

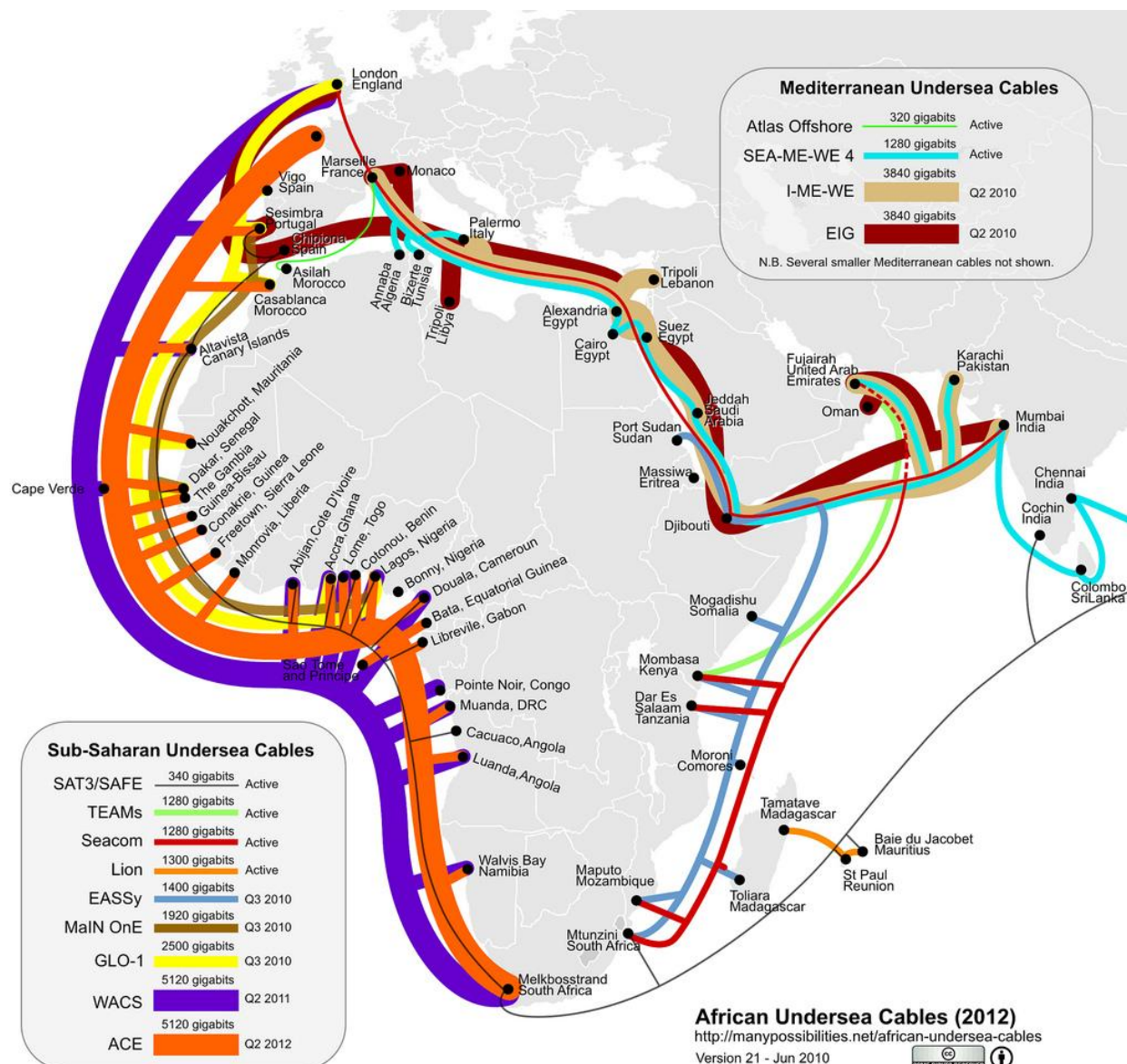


Figure 23. African Undersea Cable Maps

The Consultants support the decision by GoL, LTA, operators and other stakeholders to participate in ACE, as the costs of not participating were substantial. These costs would have included:

- **Uncertainty and Cost of Other Options:** While a number of cable landing options currently being discussed for West Coast of Africa, the Consultants believe that ACE is likely the lowest risk and the lowest cost among these options. Other options include (and are discussed in more detail in the Consultant's Rapid Assessment Report dated March 24, 2010):
 - GLO-1: reportedly a troubled project, which is completed but not operational (2010-03), possible future contender depending on cost and conditions to break into (owned by single Nigerian operator, Globacom).
 - WACS: under construction, unlikely contender because of cost to design, break into trunk, and lay branch cable will likely be higher than ACE.
 - Main One: under construction for 2010 completion, unlikely contender because of cost to design, break into trunk, and lay branch cable will likely be higher than ACE.
 - SAT-3: already operational, high cost to break into trunk, unclear how much capacity still available.
 - Infinity One: unknown status and schedule.
- **High Cost of Breaking into Existing Cables:** The cost is high of breaking into an existing cable such as SAT-3 or a cable that is currently under construction such as WACS (through adding a branch onto the trunk cable). In the view of the Consultants the costs are likely in the range of \$25 million or more. Cost components associated with breaking into an existing cable include the development of the engineering and design plans, mobilization of a ship, deployment of a submersible to build the branch, break into the trunk and run the cable to new Monrovia landing point. The Consultants were advised by industry sources that WACS is now closed, even though construction is still taking place.
- **Potential Delay of Future Cables Due to Possible Bandwidth Glut:** Future cable projects may be delayed if existing cable builds result in a capacity surplus for 3 to 5 years resulting in a "bandwidth glut". Therefore, if Liberia does not participate in ACE, an extended period may elapse before Liberia can participate in the next cable to be constructed.
- **Lost Opportunity Cost:** The highest cost associated with not participating in ACE is the lost opportunity cost to the Liberian economy of lack of low cost bandwidth. Costs for internet access in Liberia are in the range of \$3-7,000 / MB per month compared to \$10/MB in developed countries. As a result, the competitiveness of the Liberian economy and access to market sensitive information needed by Liberian businesses to compete is severely constrained.
- **Cost of Access Declining Across Africa:** The cost of internet access across Africa is declining rapidly with the increasing availability of multiple sources of international connectivity. As access costs in neighbouring countries continue to decline, Liberia will increasingly be stranded as a high cost marketplace with limited access to international markets and information.

4. UNIVERSAL ACCESS

We have found it useful to use the term "universal access" in this report. This term has been defined in many ways in different countries, such as a phone for every settlement with over 'X' population (500 people in Ghana); a phone within a certain distance of everyone (20 km in Burkina Faso); or a phone within a certain traveling time (such as 30 minutes in South Africa). Other countries focus on getting at least one line into all villages and localities, such as Mexico, Thailand and Poland. The national goals can be a mix of different elements, for example China has a policy of "One family, one telephone" in urban

areas and a telephone in every village by the year 2000. These targets change with time - as one target is met, universal access to the specific service is redefined at a higher level. For example, in India the principle is, “easier and quicker and increasing access to a public telephone for people who do not have a private subscription” - and the definitions changes as the network rollout is extended, currently any village over 2,500 or within a distance of 5 km qualify for a public telephone. We have adopted this principle in relation to broadband in Liberia, and particularly in relation to the distribution of capacity from ACE, in identifying and setting targets in the Action Plan.

In determining targets, the following can be considered:

- Providing and maintaining cost effective access to broadband services in under-served communities and low income subscriber groups without unduly disadvantaging them through higher prices.
- Developing and supporting innovative universal access programs and a clear set of realistic targets and measures.
- Achieving affordable and equitable access to networks enabling internet access, applications and services at community level.
- Mobilising available resources in policy, regulation and funding to provide electronic communications network access to the community.
- Increasing learning opportunities, including the opportunities to acquire and share information.
- Achieving increased access by defined communities in a way that enhances economic inclusion and participation which may require subsidisation.
- Providing access for people with disabilities that may include financial assistance for the implementation of specialised equipment and basic facilities for needy users.

5. COUNTRY OVERVIEW

This section provides a high-level overview of the country and the telecommunications sector.

5.1 General

This section is largely drawn from the MPEA Development Corridor study. The corridor study recommends a development strategy that focuses investments into logical corridors where diverse activities can share basic infrastructure including roads, rail lines, power, ports, water, and telecommunications. The figure below is a map showing the existing 5 corridors where economic activity is concentrated. These extend out from Monrovia along the paved roads and the Bong railway. Feeder corridors to the Monrovia-Nimba corridor include a feeder to the north-west (picking up Voinjama and Foya) and a feeder to the south-east (picking up Zwedru, Greenville, and Harper). Mining projects expected to start under the next six years should and extend corridors: (i) Buchanan to Nimba, (ii) Monrovia to Mano River via Bomi Hills and Bea Mountain, and (iii) Greenville to the Putu Range. Power, road, and railway infrastructure is of particular interest because these rights-of-way can be economically exploited for fiber-optic cable routes. If cable construction can be coordinated with power transmission line construction or road construction, then cable placement cost is minimal. These rights-of-way can also be used to improve reliability through route diversity.

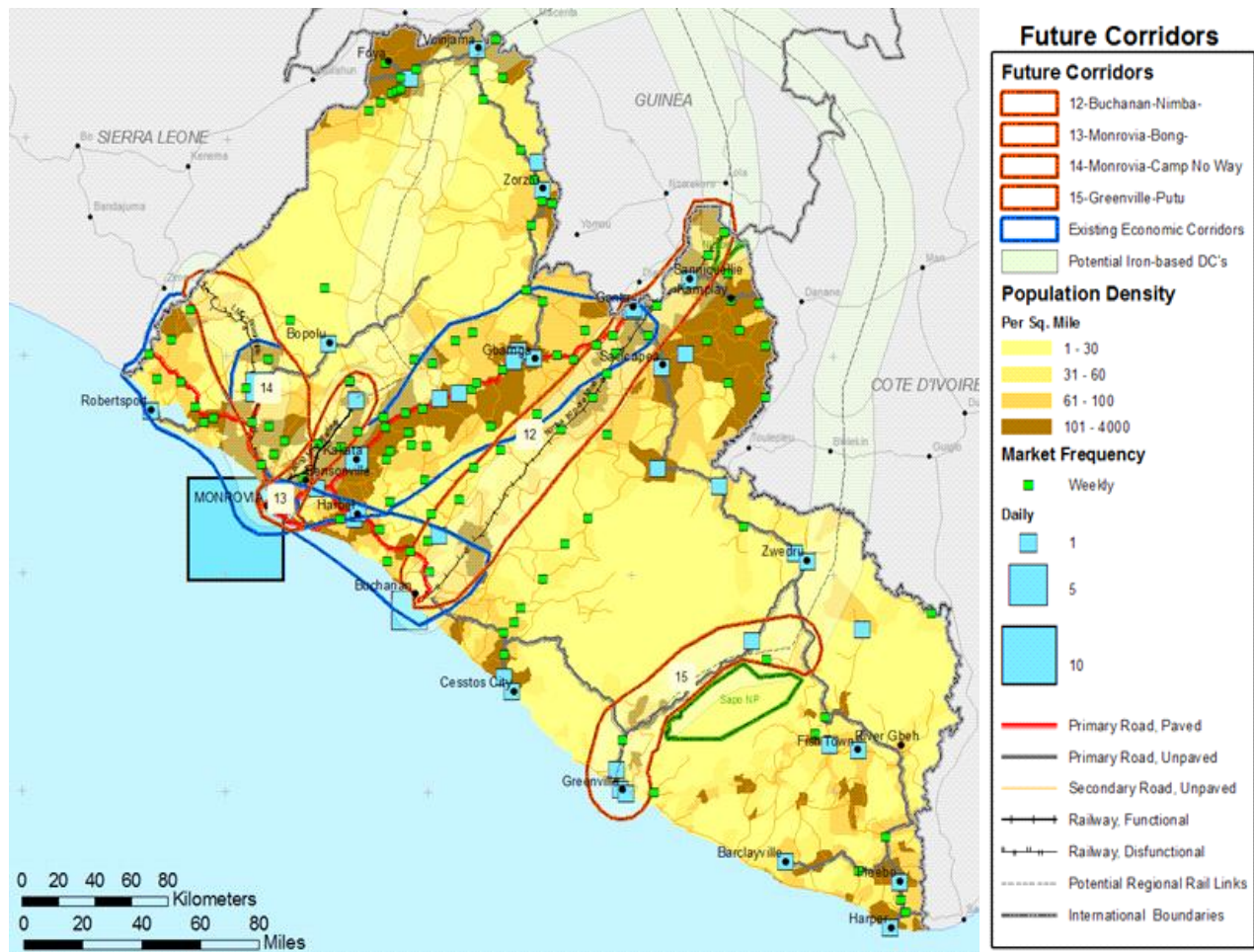


Figure 24. Economic Corridors in Liberia. Source, Map 1C

The civil conflict distorted historical population and economic trends. The economy has traditionally been based on agro-forestry (e.g., rubber), mining, and agriculture. In the 1980s mining was the economic mainstay of the economy and contributed up to 62% of export revenues. With all large scale mining operations stopped by the conflict, in 2007 agriculture made up 66% of the GDP, with industry and services making up a further 16% and 18% respectively. There remains untapped and viable iron deposits in the north-west, especially in Nimba county. Depending on commodity prices, mining investment may restart as early as next year (2011). Rehabilitation of rail lines that were destroyed, and new infrastructure construction for mining operations, will involve several billion dollars of investment and include reconstruction of the roads, rail lines, and hydroelectric power.

Government revenue in the 2007/8 fiscal year amounted to about \$207 million. Import taxes were the largest single revenue source, at 43% of the total. Government expenditures are focused on poverty reduction with education, health, and public works receiving the largest budget allocations. Donor commitments, including aid programs, charities and foreign government, during the same period were on the same order as the government's revenue. Only a small portion of these commitments have been disbursed. Donor funds are usually targeted to specific projects and interventions and often do not align with government priorities.

Road infrastructure was damaged and degraded during the conflict period mainly from lack of maintenance. In 2006 some 20-30% of the roads were still considered impassable. The national road

network totals some 9,860 km, of which less than 8% is paved. An additional 2,400 km of feeder roads were constructed, mainly by mining and logging companies; however, many of these roads are now overgrown. The three rail lines constructed for mining operations were closed during the conflict and in some instances the rails taken up and sold for scrap. The 80 km line from Monrovia to the Bong Mines is now rebuilt. The other lines, Monrovia to Mano River via Tubmanburg (145 km) and Buchanan to Yekepa (250 km) still require substantial reconstruction.

The electric power system, including generating stations as well as transmission and distribution systems, were destroyed during the conflict. This destruction included the 64 MW Mount Coffee hydroelectric plant on the St. Paul River. The Liberia Electric Corporation (LEC) is rebuilding the infrastructure and as a result public power became available in Monrovia in 2006. Today all generating plants are diesel oil fired. There is considerable potential for hydro power; however, significant time and investment is needed to bring it online. Mount Coffee restoration is estimated to take 3 to 4 years (i.e., 2013-2014). A biomass generating plant has been proposed that, if built, may be online within 1 or 2 years (e.g., 2011). Costs per kWh are estimated at \$0.34 for diesel fired, \$0.23 for biomass fired, and \$0.06 for Mount Coffee hydro. Longer term (2018-2020), the Economic Community Of West African States (ECOWAS) plan for the West African Power Pool (WAPP) may create a regional (14 country) grid and make power available at approximately \$0.09 per kWh. The availability and cost of electric power is important for overall economic development, including ICT.

Figure 26 summarizes national data on Liberia and Figure 25 summarizes county level data. Data from these tables are used later in this section to assess the requirements and demand for telecommunications in support of ICT services.

Table 2.2 County level data and assumptions used for demand and provisioning estimates.													
			Political		School	Hosp +	Health	Busi-					Area
			5	19	139	1	12	48	30,027	17,030	67,089	84,119	1,932
2	Bong		12	76	387	5	47	192	79,129	102,709	230,772	333,481	8,754
3			7	19	118	1	12	48	17,719	7,768	75,620	83,388	9,953
4		Buchanan	7	51	296	4	32	128	34,863	58,956	162,737	221,693	7,814
5	Grand Cape Mount		6	29	174	2	18	73	34,893	8,145	118,931	127,076	4,781
6			8	29	144	2	18	72	31,976	41,673	83,585	125,258	10,855
7			17	13	148	1	8	33	11,570	3,699	54,214	57,913	3,895
8			7	63	287	4	39	159	42,790	83,150	193,713	276,863	9,982
9			4	48	216	3	30	121	88,704	88,868	121,055	209,923	2,691
10	Maryland	Harper	7	31	138	2	19	78	38,024	46,981	88,957	135,938	2,297
11			3	256	1133	19	159	643	33,996	1,036,127	82,114	1,118,241	1,880
12			17	105	603	7	66	266	25,370	105,335	356,691	462,026	11,551
13	River Gee	Fish Town	10	15	119	1	10	38	10,934	17,519	49,270	66,789	5,654
14			8	16	120	1	10	41	12,630	2,389	69,120	71,509	5,113
15			17	23	192	2	15	59	15,715	13,370	89,021	102,391	9,764
Totals				793	4,214	55	495	2,000	508,340	1,633,719	1,842,889	3,476,608	96,916
Clans, Hospitals and Health Centers (Hosp + Hlth Ctr), Health Clinics, and businesses per county were estimated from national figures													

[Source: GVIC-0301 Liberia Broadband Program Model.ods - Rev0]

Figure 25. National Data on Liberia

Figure 26. Liberia National Data and Assumptions

5.2 Telecommunications Sector

Mobile service based on the GSM standard is available throughout much of the country. Four private sector operators compete for customers: Lonestar, Cellcom, Comium, and Libercell. Lonestar has the largest subscriber base followed by Cellcom. These two operators have deployed significant coverage outside of Monrovia. Lonestar has service in all 15 county capitals, and although they operate an extensive terrestrial microwave network, nine VSAT sites provide remote county coverage. All of these mobile operator backbone networks are generally medium capacity and optimized to support 2nd generation (2G) GSM based cellular mobile service. The figures below are current coverage maps from the mobile operators.

#	Parameter (units)	Value
	Population 2008 census (millions)	3.48
	Population annual growth forecast (%)	2.0%
	Land area (km2)	96,916
	GDP purchasing power parity, 2009 (\$millions) [Y2]	1,627
	GDP real growth rate 2010 forecast [Y4]	5.0%
	GDP annual growth since 2006, lowest (%)	7.0%
	GDP annual growth since 2006 highest (%)	10.0%
	Telecoms market in 2009 [X2] (\$ millions)	125
	Estimated mobile phones in 2009	1,000,000
	Number of GSM operators in 2010	4
	Number of CDMA2000 operators in 2010	1
	Number of WiMAX licenses in 2010, at least	2
	Number of access ISPs in 2007 *	11
	Number of access ISPs in 2010 *	4
	Number of international gateway operators	6
	Cost of electricity, diesel fired generation (\$/kWh)	0.5

* Excludes GSM and CDMA operators.

[Source: GVIC-0301 Liberia Broadband Program Model.ods - Rev0]

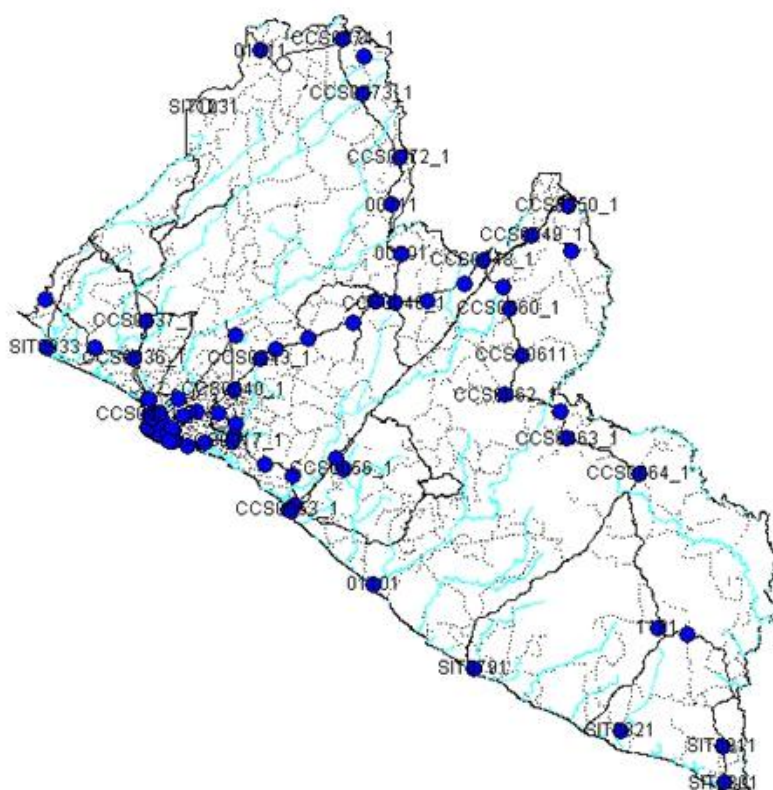


Figure 27. Mobile Coverage Map for Cellcom. Received from Cellcom 2010-04-17



Figure 28. Mobile Coverage Map for Comium. (Online at www.comium.com.lr, Visited 2010-04-17)

The government owned Liberia Telecommunications Corporation (Libtelco, formerly LTC), is the designated National Operator. This company originally operated the fixed telephone system in Liberia. The original telephone system was completely destroyed by the end of the war and the only useful assets remaining were the Monrovia duct system and some land with buildings and towers at various locations throughout the country. Libtelco plans to deploy a fiber optic network within Greater Monrovia -- a request for tender has been issued and construction is expected to start in 2010. The original LTC radio network extended to most or possibly all County capitals and seems to have included over 40 sites. All power and electronics were looted or destroyed during the conflict. Based on a 2006 inventory, about 14 sites outside of Monrovia (Montserrado) have towers in usable condition with 12 of these in use by one or more of the mobile operators. At least 3 more of these sites are in use by one or more mobile operators who have built their own tower. Although significantly rejuvenated and operating a CDMA2000 radio based system that provides voice and data service in Greater Monrovia (including the airport), Libtelco is struggling from a lack of financing. As noted in the ICT Policy [x1], Libtelco is slated for privatization, which should resolve its lack of access to capital for expansion.

Three years ago eleven internet service providers (ISPs) formed the ISP Association of Liberia. The main purpose was to lobby against LTA proposed license fee hikes from \$1,500 per year to \$30,000. Eventually the license fee was set at \$3,000. Today only 3 or 4 of the 11 ISPs remain. Impediments include high cost of satellite bandwidth, lack of electrical power to support a large personal computer population, and stiff competition from the mobile operators and Libtelco who have cellular mobile based infrastructure in place. The co-location policy should help the ISPs. The 2009 internet market for internet access was estimated to be approximately \$4 million, of which the ISPs may have up to 25% market share.

Liberia is a member of ECOWAS. ECOWAS fosters regional cooperation and harmonization -- including communications and transportation. Although the Consultants have not located any relevant regional plans, they likely exist. Interconnecting national telecommunication backbones at border points avoids the cost of transit through offshore countries (e.g., Europe). Lower trans-border communication costs will support growth of regional cooperation and trade.

Year	Mobile Penetration (% of Population)
2005	4.5%
2006	11%
2007	18%
2008	23% (estimate)
2009	28%
2010	34% (predicted)
2011	40% (predicted)

Figure 29. Mobile Penetration as a Percent of Population

5.3 ICT Policy

The GoL's short term development strategy for poverty reduction has four pillars: (i) enhancing national security, (ii) strengthening governance and rule of law, (iii) revitalizing the economy, and (iv) rehabilitating infrastructure and delivering basic services.

Within the framework of this development strategy, the Ministry of Posts and Telecommunications has formulated a Telecommunications / ICT Policy [X1]. The policy falls under Pillar 4, infrastructure and basic services. ICT infrastructure and services is cross cutting and will contribute to the other pillars. Key provisions of the policy include:

- Encourage partnerships and consortium of corporations and institutions to pool resources and build infrastructure. (2b)
- Encourage private sector participation. (5.3)
- Libtelco, the state owned and designated National Operator, has broad objectives relating to broadband networks. (7)
- Libtelco is entitled to duty free privileges until it is privatized at which time the privilege will be adjusted pro rata. (7.1)
- ISPs are encouraged and will have no limitation on the entry, provision and operation of internet services, and there will be minimum financial obligations and regulatory oversight. (16)
- Public internet access points (e.g., tele-centers and internet cafes) will require a no-fee Class License from LTA. (16.1)
- The government has a broad vision to create a knowledge society that avoids a "digital divide" and the policy identifies opportunities including e-procurement, e-government, e-commerce, e-health, e-agriculture, e-education, etc. (17,18,19)
- LTA will follow ITU spectrum allocations for the Industrial, Scientific and Medical bands which are license exempt but require type approval. (21)

- The policy is to liberalize and open markets for mobile, fixed, and international services. (2i,20)
- Public licenses to be issued based on services and not technology (20.4). Universal licenses will be authorized for converged services. (22.3)
- Investment incentives, including duty and tax breaks, may be available for the development of infrastructure relating to universal access and basic service networks. (24)
- The policy supports development of a national backbone and recognizes the need for funding from the government and private sectors. Tax and duty free privileges will be reviewed by the government. (25)
- The policy supports equal access such that customers can choose from all competing service providers in a market. (27)
- Facility sharing and co-location are encouraged. (36)
- The government's goal is to reach 55% population penetration by 2013. (39)
- A universal access fund will be established to fund infrastructure to reach designated universal access communities. (41)
- The government's goal is to reach 45% of the universal access designated communities by 2013. (40)

5.4 Global ICT Trends

This section sets out in broad terms global trends in information and communication technology (ICT). The intent is to provide context for the service demand forecasts and the technology solutions that are included in this report. As may be expected, mobile services and the internet are dominant themes today, with mobile access to the internet being a major emerging phenomenon.

5.4.1 Convergence

Although "convergence" is accused of being an overworked term, it is the right word to describe the ICT industry. First there was technology convergence brought on by all communication forms becoming digital -- including text, voice, music, images, and video. This led to a second convergence wherein all of these various communications services or applications could be carried on the same digital communication system. Furthermore, this convergence also made it easy to mix and match services and applications on a single computer based communication terminal -- for example, a browser on a personal computer to surf the web. This convergence of services allowed telephone, data and cable television operators to offer all services, and in doing so, compete with each other for customers.

Overall, the industry can be visualized as two layers. The bottom layer consists of competing network service providers (e.g, telephone, mobile, cable TV, etc.). The top layer consists of competing content and application providers (AOL, Google, Yahoo, Facebook, YouTube, TV networks, Hulu, etc.) that use the network layer to deliver services to internet users. The connection between the network and application layers is the Internet suite of protocols. Although network facilities are expensive to build and operate, they exhibit high economies of scale (discussed later). Additionally, competition in the network layer has improved efficiency and driven down costs. The relatively low cost of entry and exit for content and application providers has stimulated innovation and competition. The result has been a profusion of new services and capabilities (YouTube, Google Earth, and social networks such as Facebook, to mention but a few).

5.4.2 Computing

The revolution in telecommunications was largely brought about by computer technology. Since the 1970s, computing power has doubled every 18 to 24 months (Moore's Law). At first computers were used

to automate mechanical and human operator functions within the telephone network. Then digitalization and computers made entirely new network solutions possible. The dominant network on the planet today, the internet, was born as a network to interconnect computers.

Recently the cost of communication, essentially the cost per "bit" of data (and this bit may represent any service or application including voice and video), has been declining even faster than the cost of computing. Small-scale computing often has inherently low efficiency -- consider how much time a personal computer is used versus the total time it is on, and also all the quiet time at a data center that only serves users in one time zone. These factors are leading to new optimum's in the industry as network costs are "traded off" against computing costs. Specifically, very large-scale computing infrastructure with significant economies of scale are located where electricity cost is low and internet connectivity is excellent. This is the concept behind so-called "cloud" computing. Amazon, Google, IBM, Microsoft and others, including some telecommunication service providers, are all making or planning plays in this market. In some cases, such as Microsoft and IBM, the intent is to protect their software market share.

Another computing trend is the convergence (there's that word again) that occurs as personal computers become smaller and more mobile while mobile telephones become smarter and more computer-like. A host of new internet devices have been introduced over the past few years -- tablets, notebooks, and smart phones of different sizes and feature sets. The launch of the iPhone and iPad by Apple in 2008 and 2010 will be viewed as watershed events in the evolution and convergence of the internet with mobile.

5.4.3 Internet

The internet is a global network of networks. It was made possible by the Internet Protocol (IP). In simple terms, IP is a universally agreed addressing scheme that enables messages to be passed between computer hosts that reside on different networks. Many other compatible protocols are needed to make the system work and to support various other functions. The open and public nature of the Internet Engineering Task Force (IETF) standards setting process has been a winning formula. The evolution of the internet to support new services with improved performance and scalability, has led to competition, innovation, low-cost and near ubiquitous availability. The culmination of these factors produced a huge and growing information space that anyone can access and contribute to.

Despite its many strengths, the internet still has shortcomings. Security, providing reliable quality of service for real-time voice and video, and support for mobility have been ongoing challenges. The current IP version (IPv4) is also running out of addresses. Over the next few years the transition to IPv6 will help resolve most if not all of these issues.

Possibly the most serious internet shortcoming has been the cost of internet terminals and broadband "last-mile" access. Traditionally you needed a computer worth several hundred to a thousand dollars and a broadband internet connection with a capital cost from a few hundred to a few thousand dollars. Fortunately a solution is emerging. As discussed next, cellular mobile technology has the potential to reduce terminal and access costs by an order of magnitude.

5.4.4 Cellular Mobile

In 2006, the number of cellular mobile telephone subscribers surpassed those with fixed lines. For all practical purposes, mobile phones are replacing fixed lines as "basic telephone" service. In developed countries, mobile phone subscriptions are beginning to exceed 100% population penetration because (i) some people have more than one mobile and (ii) the service is beginning to be used for machine to machine communications (e.g., point of sale, security systems, and for smart grid power utility applications). In many developed countries, fixed line telephone service numbers are in decline. In developing countries fixed telephone line growth has slowed and generally stopped. This is the result of a competitive supply of low-cost, high-value mobile services that emerged as regulatory regimes were reformed and began to exploit the private sector and competition.

The average revenue per user (ARPU) per month is around \$40-\$50 in developed countries and \$10-\$12 in developing countries with low per capita gross domestic product (GDP). The average cost of mobile handsets worldwide is in the \$100-\$150 range. Basic mobile handsets for developing countries are available for as low as \$10-\$20.

An important characteristic of mobile service has been the evolution of capability. In the past two decades, the service has moved from first-generation (analog) to second-generation or 2G (i.e., digital, such as GSM). Today third-generation, or 3G, with improved data handling is being deployed (this includes incompatible CDMA based standards such as EVDO for "evolved voice data optimized" and HSPA for "high speed packet access"). On the horizon, there is fourth-generation technology, or 4G, that is optimized for packet transport end to end. Early mover operators are beginning commercial 4G service this year (2010) and next. A technology buzz word for 4G is LTE, which stands for "Long Term Evolution" of the GSM cellular mobile platform. A design objective of 4G is to reduce the cost per bit for capacity and therefore enable new revenue streams. To exploit this more affordable capacity, suitable handsets and user terminals are required. So-called smart phones are the first wave of suitable devices -- i.e., handsets that can access the internet and deliver a satisfactory user experience. Last year (2009), 14% of mobile handsets sales worldwide were smart phones (according to Gartner). Networks and small form factor computers, such as tablets, are also contending for market share and will become more important as 3G and 4G mobile infrastructure becomes prevalent.

WiMAX is another open standard. However unlike cellular mobile telephone standards that evolved from telephone administration associated standards development organizations (like the ITU and ETSI), WiMAX standards were championed by the IEEE and evolved from a computer centric technology base. In some ways WiMAX competes with 3G and 4G cellular mobile -- in other ways, the technologies are seen as complementary. Undeniably, the threat each poses to the other has been good for the market, accelerating technology development and driving down consumer prices.

Frequency bands for cellular mobile traditionally included 800, 900, 1800, and 1900 MHz. The 700 and 2100 MHz bands are currently poised to become important. There are WiMAX profiles for frequency bands at 2300, 2500 and 3400-3800 MHz. In general, the lower frequencies provide better range and are, therefore, particularly useful when service is first deployed and subscriber density is low. Each cell site typically costs from a few tens of thousands of dollars to a few hundred thousand dollars. The cost spread depends on cell capacity, power, antenna system, and support facilities (tower, power, and equipment shelter). For subscriber affordability, these costs must be spread across a sufficiently large customer base. Therefore, typically each cell site needs to serve a few hundred to a few thousand subscribers.

License-exempt spectrum is available in the ISM (Industrial Scientific and Medical) bands at 900, 2400 and 5200-5800 MHz. Additional license-exempt spectrum has also been allocated at 60 GHz (very short range, typically less than 1 km, but high capacity, typically over 1 Gbps). Non-exclusive licensed spectrum has been allocated by many jurisdictions at 3650-3700 MHz and a range of WiMAX vendors have announced products for this band.

In conclusion, affordable internet access over next generation cellular infrastructure (e.g., 3G, 4G and/or WiMAX) may be one of the most significant milestones so far on the road to a global information society.

5.4.5 Network Economies of Scale

There are two important consequences of the economies that occur as networks scale up. The first is that, while per user unit costs fall with increasing numbers of users (scale), the value of the network increases. As shown in the figure below, at some point, the value of the service to the user exceeds the cost of the service to the user and growth is self-sustaining. Note that below this point, some form of subsidy may be needed. The second consequence is, that as the network scales up and the unit cost curve flattens (economy of scale is reached), there is room for multiple physical networks to compete.

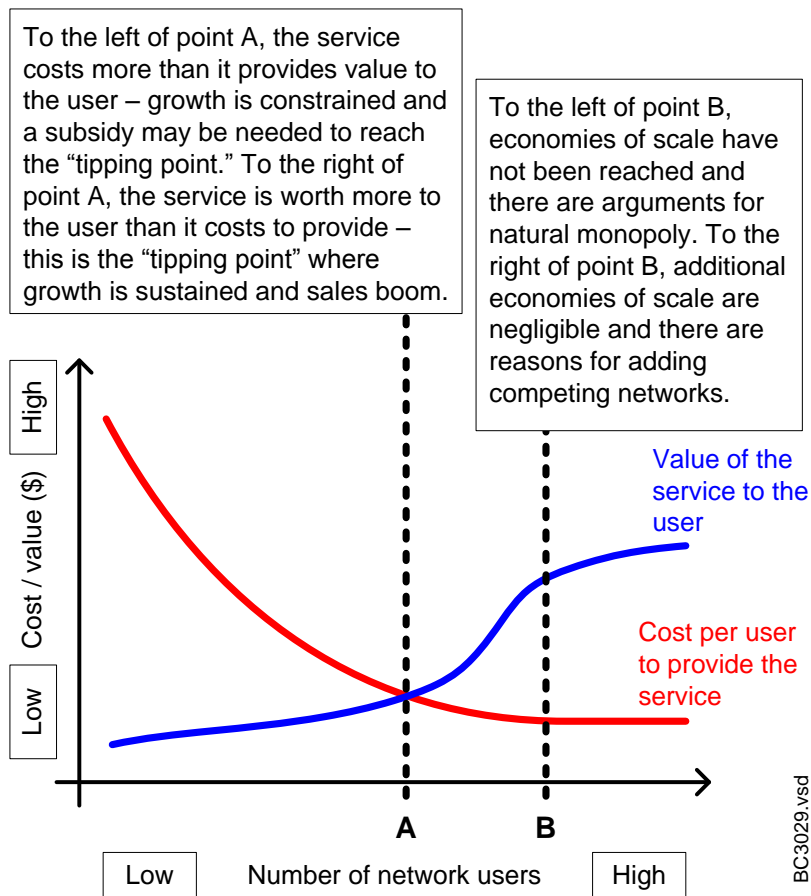


Figure 30. The Concept of Network Economies of Scale. There Are Consequences for Growth, Subsidy, and the Introduction of Competition.

5.4.6 Network Design

Because not everyone wants to communicate with everyone else all of the time, networks do not need to have capacity to constantly connect everyone to everyone else. Essentially the more expensive parts of the network are shared to make the network overall more cost-effective. Network design involves deciding how much capacity will provide an adequate grade of service (i.e. low probability of connection blocking or delay through the "shared" parts), and how to configure what types of transmission and switching or routing facilities for best overall economy.

Networks are constructed in a hierarchy. At the bottom of the hierarchy access networks connect users or locations within a local area or community. Above this are wide area networks that connect together the access networks and communities. National wide area networks connect, in turn, to top level international networks. Conceptually then there are access networks that connect subscribers (customers, users, etc.), and these access networks are interconnected by one or more levels of backbone or transport networks.

Access networks include wireline and wireless (radio based). Wireline access includes traditional copper loops using twisted pair cables (e.g. as used by a legacy telephone networks) and coaxial cables (e.g., as used by legacy cable television operations), as well as, fiber-optic cables (e.g. used by emerging fiber-to-the-premises broadband service providers). Digital subscriber line (DSL) and cable modem technologies were developed to exploit the broadband capability of legacy twisted pair and coaxial copper facilities, respectively. For greenfield developments (i.e., no significant existing network infrastructure), fiber-optic

cable is the access network transmission media of choice -- particularly for extending services to businesses, institutions, and multi-dwelling units (i.e., apartment buildings). As noted above, in the discussion on cellular mobile service, wireless access to mobile devices is the dominant access network media -- and will remain so for the foreseeable future. In summary, fiber-based access networks apply where the demand concentration is high, with radio based access networks pertaining everywhere else.

Transport networks are the backbones that connect the access networks together. Examples include: base station backhaul networks, intercity long-distance networks, and international facilities between countries. The cost of the transmission media dominates the cost equation for transport networks, and the most cost-effective media depends on the capacity requirements. Fiber optic cable, microwave radio, and satellite are the three principle transmission media. As shown in the figure below, they are mainly differentiated by capacity. Although not shown by this chart, the cost of fiber and radio based systems increases linearly with distance, whereas satellite service is distance independent (i.e., the cost of transport does not change with distance as long as the end points are within the satellite's coverage beam). A satellite system designed from the ground up for broadband is O3b (for "other 3 billion") should push the capacity envelope than shown in the chart and may be economical into the 100 Mbps range. This system is scheduled launch satellites into medium earth orbit in 2012. O3b is further discussed later in this report.

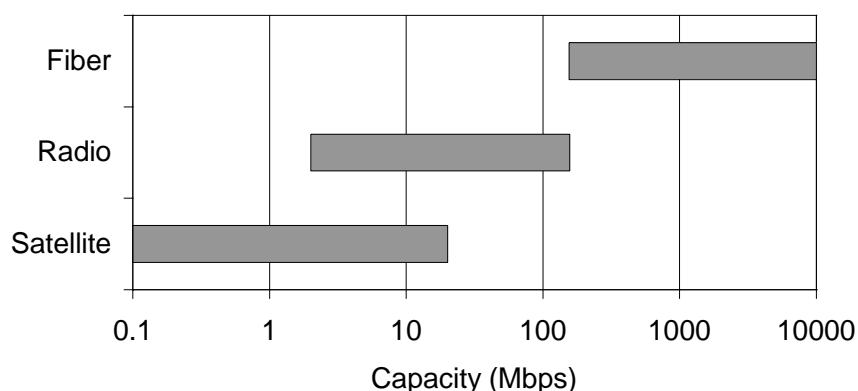


Figure 31. Economic Capacity Ranges (Sweet Spots) for Transport Network Transmission Media

There are different ways of aggregating (combining or multiplexing) traffic onto the transport media. The Synchronous Digital Hierarchy (SDH) is a dominant legacy multiplex standard for capacities over 155 Mbps (STM-1). Below this capacity, multiples of E1 (2.048 Mbps) are common. E1 and SDH are optimized for the circuit switched world of classic voice telephony. As more traffic is Internet Protocol (IP), multiplex schemes based on Ethernet (IEEE Standard 802.3) are emerging. Routing across a transport network is accomplished by switches and routers. In the circuit switched world of classic telephony, these were the transit centers. In the packet switched world of the internet, these are routers. Telecom networks have largely evolved from carrying primarily circuit switched traffic, to carrying primarily packet based traffic (the cross over in traffic volume actually occurred in 1997). Consequently circuit optimized technologies such as SDH are giving way to more packet and Internet Protocol (IP) friendly multiplex schemes. Recent trends include: (i) higher density wavelength division multiplexing (WDM) for fiber optic cable systems, and (ii) lower cost and higher performance technologies that use each optical wavelength, such as multi-protocol label switching (MPLS) and carrier Ethernet.

5.4.7 Power

In developing countries the availability of commercial power is an impediment to ICT. At the network facility level, wireless access base station sites typically require one or two kilo Watts (kW) or more of power for the base station equipment and backhaul radio terminal. This issue is recognized including within the context of climate change. The GSM Association (GSMA) has formed a Green Power for Mobile (GPM) program to facilitate collaboration within the mobile operator and vendor communities and accelerate the deployment of green power solutions (www.gsmworld.com). Nonetheless progress is slow. Hybrid generating systems that include wind and/or solar to offset diesel fuel consumption have met with some success at the cost of increased complexity. Most gains can be achieved through passive and/or active site sharing. The feasibility of sharing depends on the competitive environment including regulations.

At the subscriber level, the lack of commercial power is a problem for handset charging and for powering computer terminals. Because mobile handset power requirements are very low, alternate meanings such as solar power and hand crank generators are feasible and readily available. In developing countries, mobile operators can also set up public charging facilities at their base station sites. In the longer term improvements in efficiency and charging technologies may obviate the need for external charging. Unfortunately a counter-trend is the move to smart phone handsets with more capabilities and net-book computers, which consume ever more power. In any event, innovations in mobile handset technology hold the most promise for minimizing, or even eliminating, the need for external charging user devices.

As noted elsewhere in this report, cooperation between mobile operators and the Liberia Electric Corporation (LEC) could be used to bring power to rural communities in advance of the national grid. Essentially the mobile operator would size their electric generators to include power for schools, medical facilities, and other critical infrastructure in the community. The LEC would participate by constructing the necessary electric power distribution systems.

5.4.8 Conclusion

The internet is carrying all existing communication services (telephone, data, and video) as well as enabling new and emerging services and applications. Affordable access to the public internet enables and empowers individuals and societies. In the long term, only fiber-optic based transport networks have the capacity to form the backbone. The evolution of wireless access is poised to transform the convenience, and affordability, of internet access. These trends suggest that Liberia should: (i) as demand emerges, plan and build a high-performance fiber-optic national backbone network that is optimized for packet transport; and (ii) take steps to encourage and facilitate the deployment of open-standards based wireless access networks.

5.5 Demand Forecast

Information and communications technology (ICT) is "crosscutting" and the availability of ICT is an economic force multiplier for essentially all traditional sectors. This section of the situation analysis draws on the earlier information and discussion to concisely set out the requirements in terms of: (i) connectivity by geographic location, (ii) demand expressed as number of customers (users or subscribers including government and business entities as well as individuals) and traffic handling capacity or bandwidth (quantified here as mega bits per second (Mbps) of capacity), and (iii) basic quality of service parameters. Because network assets under consideration, such as fiber optic cable facilities, have economic life spans on the order of 15 years, the requirements are forecast across 15 years. The difference between the current situation and the requirements, including future forecasts, defines the gap to be closed. These requirements are also the underlying objectives that design and implementation options need to be evaluated against.

5.5.1 Connectivity

The ICT policy prioritizes high-capacity international connectivity to the global internet as well as the distribution of this capacity throughout Liberia. The policy calls for a universal service fund to help push this connectivity into the rural sector. In this area, where costs are high and economic density is low, transfer payments are required to close the "digital divide." Therefore, in order of priority, broadband connectivity is required: (i) to the global internet; (ii) to the county capitals; (iii) to the district headquarters; and (iv) to the clan level. Access to this broadband connectivity must be open, equitable, and affordable across all market segments (government, NGOs, business, and individual consumers).

Broadband demand is very sensitive to changes in price, with even relatively small reductions in price expected to result in substantial increases in penetration in Africa. As the following chart indicates, a compound annual decline of 3% in cost of broadband access in the Africa and Middle East region is expected to more than quadruple penetration rate by 2015.

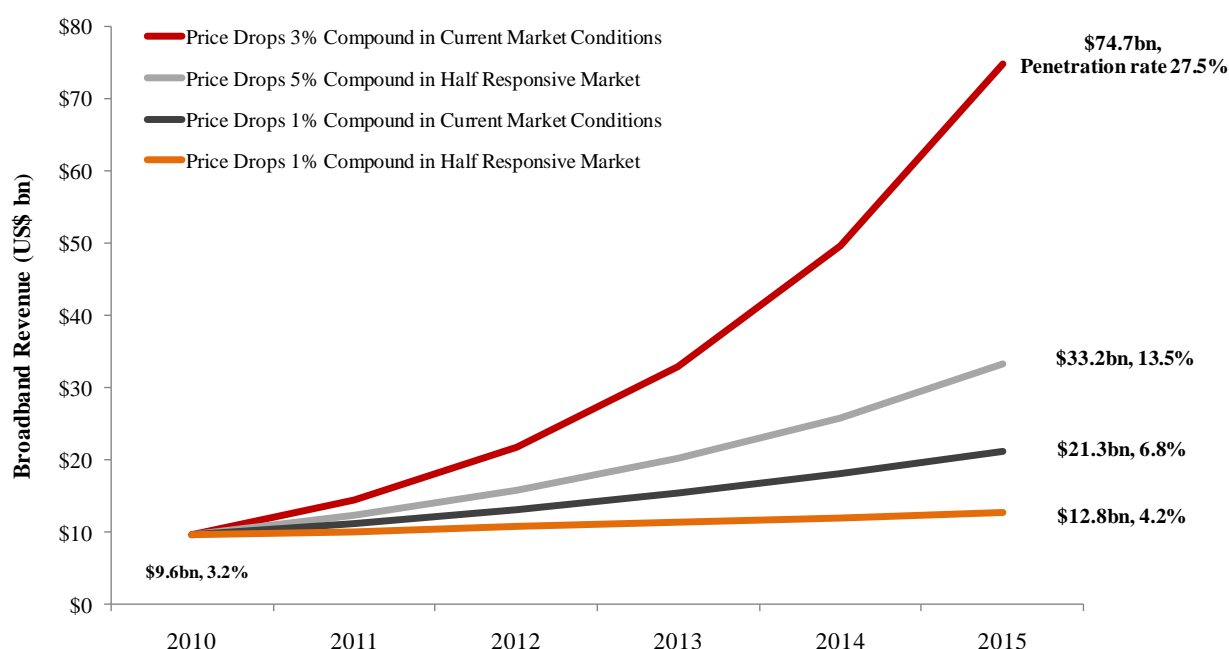


Figure 32. Simulated Broadband Penetration And Revenue Potentials in the Region⁴¹

5.5.2 Demand

The tables below outline the demand forecast assumptions and provisioning guidelines used to estimate customer and traffic demand. Using these guidelines and country and county data from earlier tables, the customer and traffic forecasts in the four figures below were prepared.

⁴¹ Pyramid Research, New Undersea Cables Help Boost Africa's Broadband Prospects: The role of African regulators to facilitate market development and ensure affordable prices, presented by Sonia Jorge, Research Director, at the ITU-FTRA, Banjul, The Gambia, July 12-14, 2010.

Table 2.4 Dem and forecast assumptions and provisioning guidelines.				
Design average capacity in Mbps				
		0.1	0.1	1.0
	Per Ministry of Education district office	0.05	0.05	0.5
	Per school	0.1	0.1	1.0
	Per hospital and health center	0.2	0.1	1.0
	Per government county level office	0.1	0.1	1.0
	Per government district headquarters	0.05	0.05	0.6
	Per large business (includes NGOs)	1	0.1	2.0
	Per medium business (includes NGOs)	0.1	0.05	1.0
	Per residential broadband consumer	0.1	0.1	0.6
	Per mobile internet consumer	0.005	0.005	0.060
Capacity assumption as number of mobile consumer equivalents				
	Per health clinic	3	0	3
	Per government clan headquarters	2	0	2
	Per small business	1	1	4
Growth and distribution of business market segment				
	Number of businesses		200	5000
	Large businesses as fraction of total	0.01	Nil	
		0.1	Nil	
		0.003		1.000
	Year that 37% of saturation figure is reached	2018		8
	Growth rate factor, Gompertz "b" variable	0.4		
Residential broadband internet market segment, initial size and growth				
	Number of customers (thousands)	0		30
	Growth follows same curve as mobile internet consumers above.			
Traffic distribution assumptions				
	Government traffic that is national, proportion	0.7	0.05	0.95
	All other traffic that is national, proportion	0.02	0.02	0.2
	Pro rata county capital population of district	0.3	-	-
	Pro rata district headquarters of county	0.2	-	-
	Pro rata clan headquarters of county	0.5	-	-
Linear annual growth to saturation ("Max") is assumed; except "Gomp"				

Figure 33. Demand Forecast Assumptions

F forecasts the number of network customer connections or locations broken out by market sector (note - the y-axis is log scaled). From this graph it is noted that: (i) government and business traffic are significant components of early demand; (ii) the number of businesses will grow slowly while government remains essentially flat; (iii) in terms of numbers, mobile internet subscribers will grow and dominate eventually; and (iv) residential broadband customers become significant but trail mobile internet customers by over an order of magnitude.

Graph 29 and 31 show traffic forecasts for Montserrado (the county that includes Monrovia) and all other counties, respectively. From these two graphs it is evident that Monrovia will contribute about 40% to 50% of the total national demand. This split is also reflected by the international traffic forecast in Graph 30.

It should be noted that demand will be strongly affected by pricing and the overall economic conditions that prevail across time. Demand for the government market segment is based on policy and therefore, in this model, is not directly related to pricing and economic conditions.

The demand methodology is necessarily high level and conceptual, which is acceptable for strategic planning studies. The demand figures are used in Chapter 4 to prepare reference designs against and to forecast costs and potential revenues. The results will be indicative and enable strategic planners to make informed directional decisions. Subsequent planning with improved resolution can be used to confirm feasibility of specific projects within the overall strategic framework.

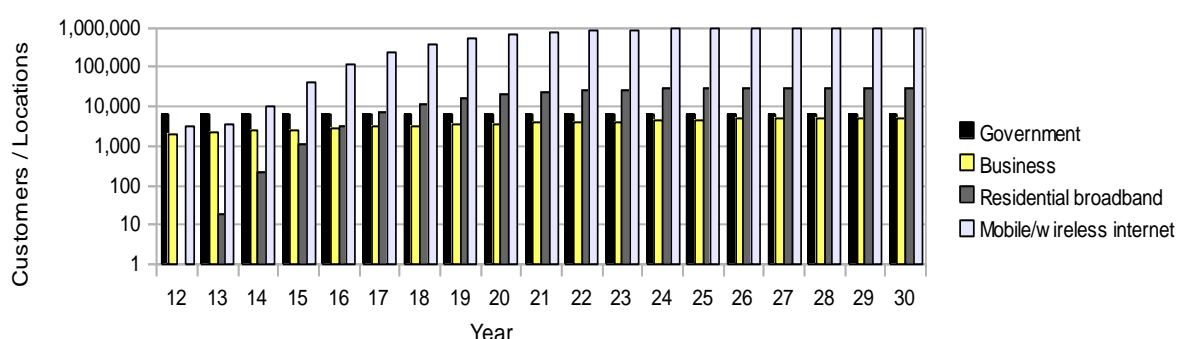


Figure 34. Forecast number of customers and customer locations requiring network connectivity.(Note: y-axis is log scale.)

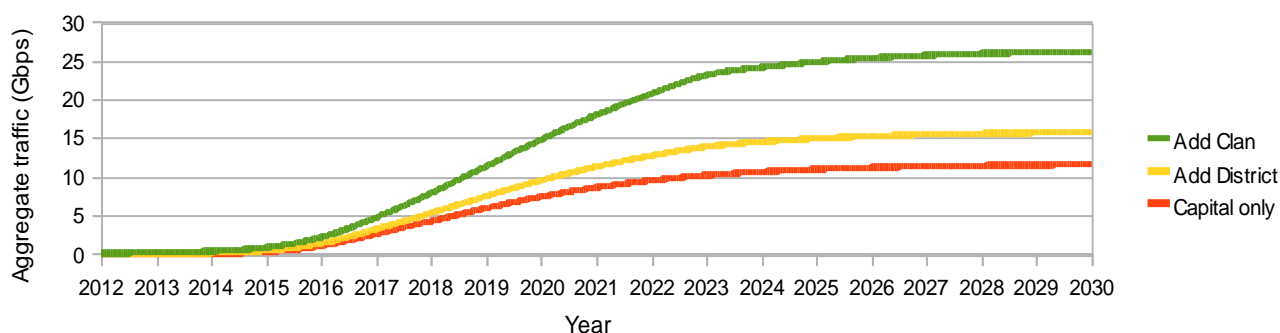


Figure 35. Traffic Forecast for Montserrado County (Monrovia) Including National and International Traffic (in Gbps)

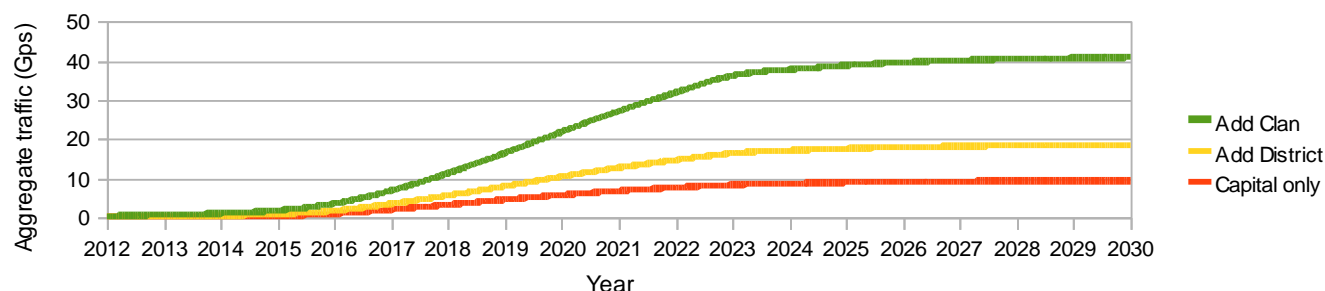


Figure 36. International Traffic Forecast in Gbps

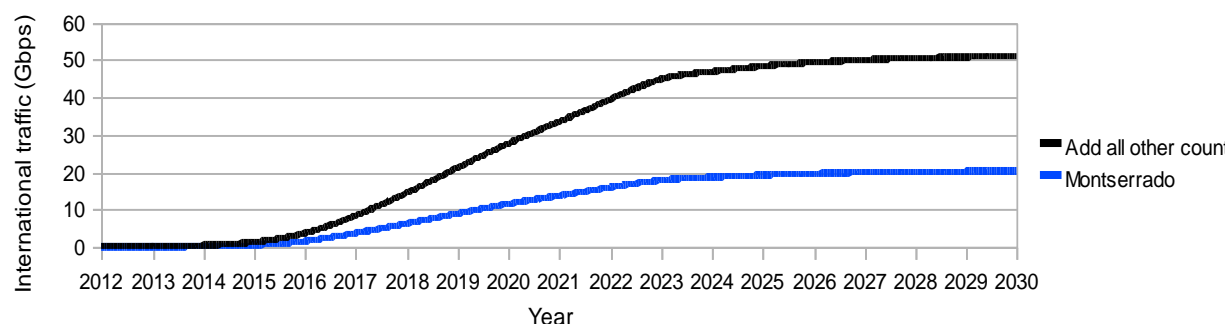


Figure 37. Aggregate Traffic Forecast for all Counties Except Montserrat in Gbps (Includes National and International Traffic).

5.6 Quality of Service

Quality of service (QoS) requirements are used by operators and regulators to attain and maintain customer satisfaction. The subject is addressed here to the extent needed such that reference designs prepared in Chapters 3 and 4 should adequately meet customer requirements. Specifically these QoS parameters include delay and reliability.

Delay or latency is how long it takes a packet of data to traverse the network. Round-trip delay (ping time) as the name implies is the go and return time. For decent real-time voice and video, one-way delay should not exceed 200 ms and preferably should be less than 130 ms.

Reliability is often best expressed in terms of percent availability -- i.e., what percent of the time is the service readily usable by customers. End to end or customer to customer availability should be over 99% to be widely acceptable. To reach this level, core network facilities that are shared by many customers must have reliability in excess of 99.9% (four and five nines at the end of the figure are common). Operators have incentives to maintain these levels since an outage on a high-capacity trunk cable means large revenue losses. To reach these high levels core facilities need to have redundancy to avoid single points of failure.

In addition to delay and availability, network operators will also maintain other quality of service parameters. For example, public internet service parameters should also include throughput, and managed data network service parameters should include these plus packet loss and jitter (delay variation). The regulator may also require operators to maintain specific parameters such as complaint/trouble rate and customer service response time statistics.

6. MONROVIA FIBER OPTIC RING AND INDIANA UNIVERSITY DONATION

In mid 2010, Libtelco announced that it had engaged ZTE to construct a limited fiber optic network in Monrovia to connect key government ministries and university campuses, financed by the Ministry of Finance using funding from an IFI. This will provide basic network infrastructure which Libtelco can then use to connect NGO's, businesses and residential users.

Libtelco has contracted with ZTE to build a fiber optic network in Monrovia to connect 6 government ministries, the University of Liberia and John F. Kennedy Hospital. The Ministry of Finance has agreed to pay ZTE's cost of \$380,000 to connect the six ministries (\$55,000 for each of six nodes) [who will pay other costs?] In return, the ministries will obtain use of "dark fiber" in the fiber optic network at no charge for 5 years and use of a data facility at Libtelco's Sinkor branch at no charge for 3 years. Libtelco has also agreed to a donation by University of Indiana of used fiber optic cable, as well as servers and routers, which will be used to link University of Liberia to the Monrovia network.

The university will obtain use of "dark fiber" in the network at no charge for 3 year years. Libtelco will operate and maintain the network. Indiana University will also provide technical expertise to assist in the installation and launch of the network.

APPENDIX 3: DEVELOPMENT OF BROADBAND CONNECTIVITY – TECHNICAL STRATEGY

The need for broadband connectivity in Liberia was established in Appendix 2: Background. In addition, the major infrastructure gaps and development impediments were identified. As a logical follow on, this appendix develops a technical strategy for extending broadband connectivity across Liberia. Consistent with the scope of the demand forecast in the Situation Analysis, the scope of the technical solutions in this appendix includes public internet and private IP network traffic. Existing voice and mobile traffic is not directly considered; however in the longer term, this traffic is indirectly included because internet and IP traffic can be expected to dominate and the facilities for this traffic will be able to accommodate the existing voice mobile traffic and its expected growth. The high capital cost of network infrastructure and ongoing operations necessitates, for affordability reasons, a long cost recovery period. Therefore a long term strategic level development plan is needed. In general terms, the strategy involves an examination of design, implementation, and funding alternatives. The overall strategy is financially and economically justified based on a high level and preliminary analysis. This approach provides a broad strategic program-level basis for action. As applicable, planning each project within the program will require preparation of preliminary and detailed feasibility studies that incorporate a business case.

After a brief summary, this appendix begins with a description of the confirmed international connectivity plans, followed by the development of conceptual technical plans to extend connectivity nationally to the county capitals and then on to the rural district and clan levels. National connectivity should be extended as a series of network expansions: (i) Monrovia network, (ii) backbone network to the county capitals, and (iii) rural networks to district and clan level. The order of this series is also the priority order for development, as it permits harvesting the easy to reach areas with high demand first. Furthermore, the order in which networks are deployed should follow economic corridor development and exploit existing and planned infrastructure. In this way, revenues from the denser urban markets and from the easier to reach areas can be used to help carry the sparse rural markets, particularly in the more remote counties, that are most expensive to reach and that will take longer for demand to develop. Based on these priorities and guidelines, a phased implementation program for national connectivity is then developed.

Note that the table values shown in blue are primary data entries whereas values in black have been derived (i.e., calculated from the primary data).

1. SUMMARY

The Cable Consortium of Liberia (CCL) is a member of the Africa Coast to Europe (ACE) submarine cable consortium. In late 2012, when the landing station in Monrovia is commissioned, Liberia will be connected to the global internet with approximately 5.3 gigabits per second (Gbps) of fiber optic broadband capacity (e.g., to a Tier-1 internet backbone provider in Europe). In the near term, some of this connectivity can be spread across Liberia by exploiting existing microwave facilities. In the longer term a national fiber-optic network to each of the 15 county capitals outside of Monrovia will be required. From these capitals, connectivity can be distributed out to the rural district and clan headquarters using standards-based wireless access technology such as 3G and 4G cellular mobile and/or WiMAX.

The initial connection from the Liberia landing point in Monrovia to operator networks is expected to be funded by the operators themselves without government subsidies or support. These investments are minimal and the availability of high performance international connectivity that some operators will have already invested in will provide sufficient incentive to construct these terrestrial tail facilities.

The national fiber-optic network to the county capitals will require approximately \$60 to \$120 million capital investment to fully deploy. The district and clan level access networks will require an additional capital investment of approximately \$100 to \$200 million. These are significant amounts and, as noted below, must be spread out over a 10 to 15 year period. Investment for distributing connectivity within the urban concentrations of Monrovia and to the county capitals is expected to be led by competing service providers (e.g., existing fixed and mobile operators, internet service providers, etc.) and has not been included in the business case analysis of this current study.

A phased implementation will reduce the annual investments, and enable the more economically active and financially viable areas to be connected first. The full nationwide fiber-optic to rural capitals may take 10 years to build; access at the district and clan level will take longer. The baseline construction program developed during this study requires a total of approximately \$85 million in capital investments between now and 2018. Specific phases can be defined and budgets estimated as investment funding becomes available and as a business model or construction authority is identified. In the near term, the existing mobile operators currently own and operate microwave systems that can be further exploited by these operators. Also, as noted earlier, there is an existing microwave route operated by UNMIL that uses existing operator radio sites and facilities to link Monrovia to the SAT-3 submarine cable landing in Côte d'Ivoire. This asset could form the initial nucleus of a terrestrial open-access national network.

To enable rapid network extension to all county capitals ahead of the fiber-optic network, and at significantly less capital expense, participation in the O3b satellite network is considered. An estimated investment of \$6 to \$10 million would provide O3b connectivity to network points of presence in each of the county capitals by 2013 (assuming O3b launches on schedule). O3b can also provide redundancy and security for the submarine cable while alternative sources and routes of international connectivity are organized (such as fiber-based cross border connections to SAT-3, additional cable landing points, etc.)

An overview of the proposed long term network architecture is shown in the figure on the next page.

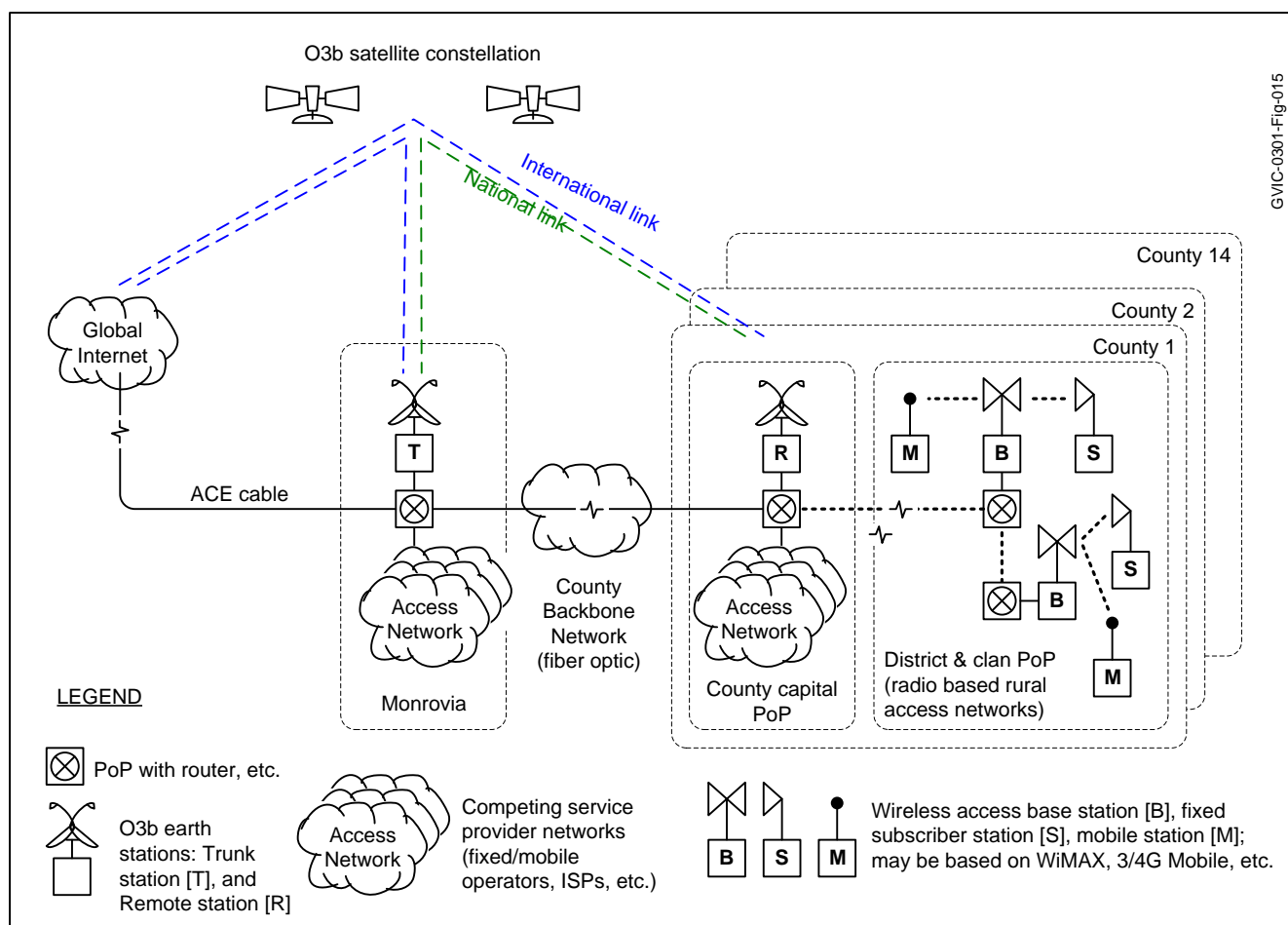


Figure 38. Network Concept Diagram for Liberia Broadband Connectivity

The national fiber-optic network to rural capitals would follow existing transportation routes as shown in the figure below, which also sets out a proposed construction sequence. A phased implementation schedule for the program is shown on the middle figure below. The last figure below presents the overall business model, with individual business units for international facilities (CCL), the county backbone network (CBN), and the rural access network (RAN).

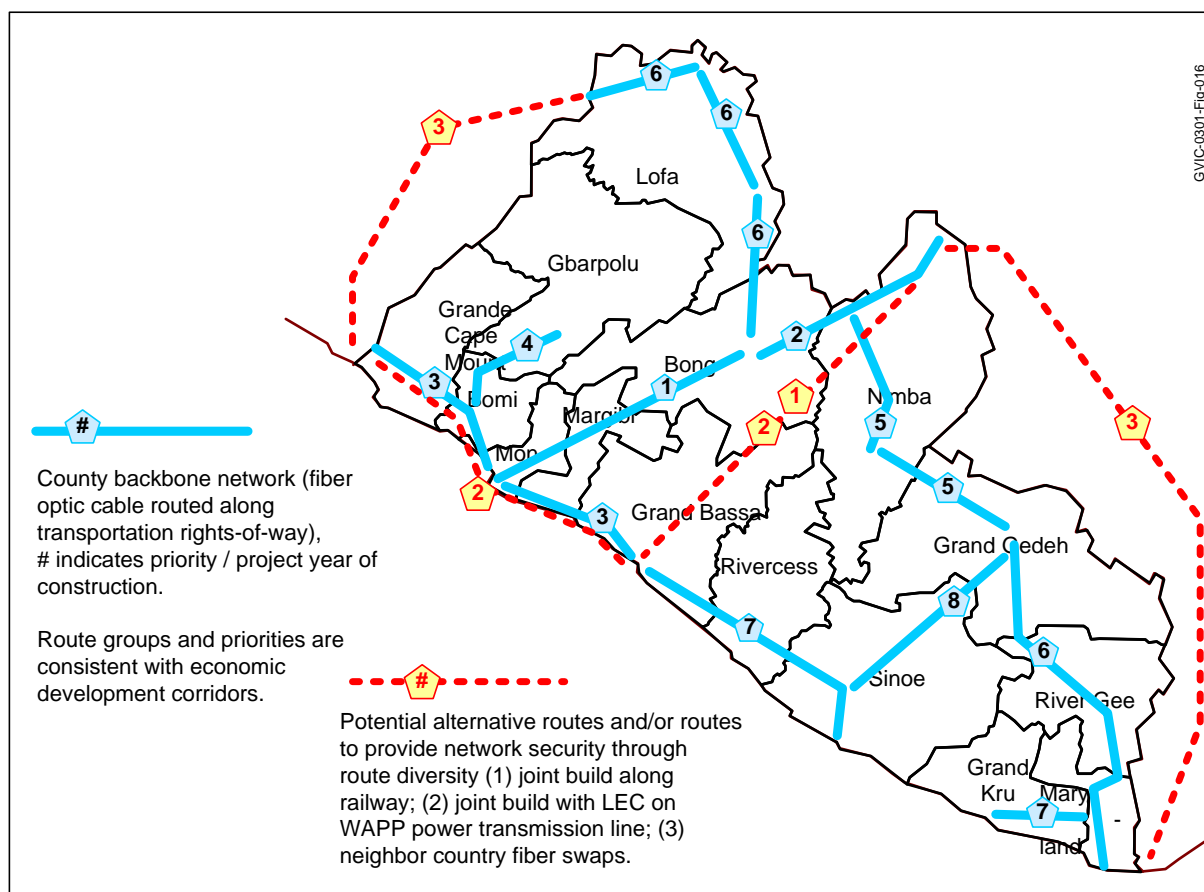


Figure 39. Routing Concept for the County Capital Backbone Network

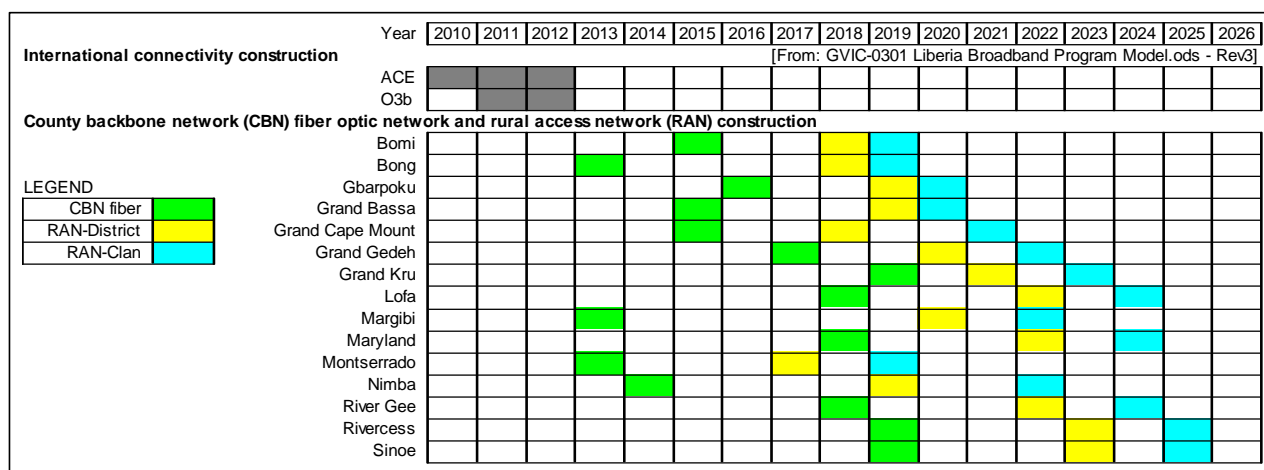


Figure 40. Preliminary Construction Schedule for Liberia Broadband Connectivity Program (Basis for Financial Analysis Model)

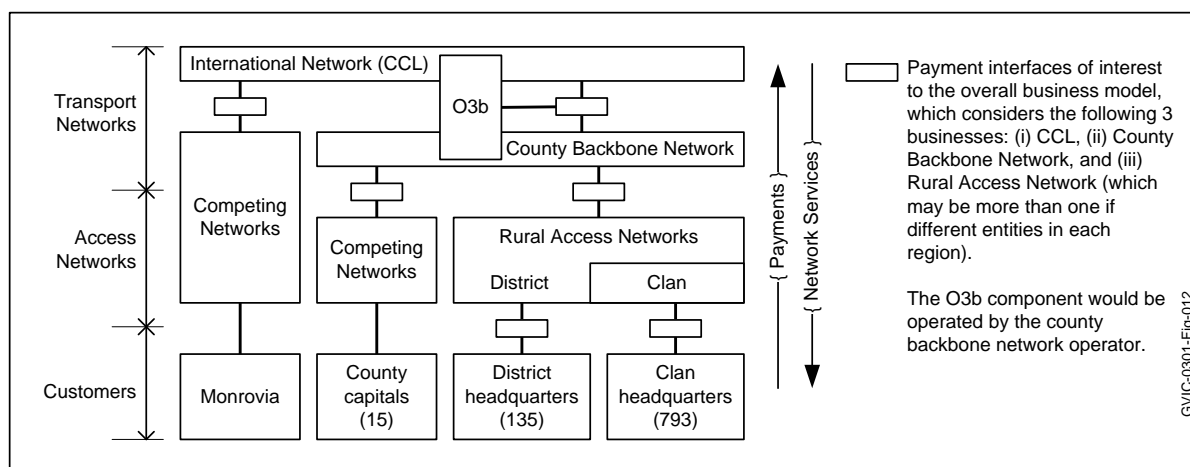


Figure 41. Simplified View of the Overall Business Model, Showing Distinct Business Entities for Open Access International Network, Open Access National Fiber Backbone (to County Capitals), and Rural Access Networks (to District and Clan Headquarter Levels)

A potentially important early component of the fiber optic backbone is expected to be a fiber optic cable which may be laid along the existing railway line from Buchanan to Nimba county when the line is rehabilitated under a Concession Agreement by an international mining and steel company. The line may be used by other mining and timber companies active in Liberia, Sierra Leone and Guinea to transport ore and other resources. An alternative that would provide fiber along this same route plus from Buchanan to Monrovia and on to Sierra Leone would be to combine fiber with the shield ground on the proposed West Africa Power Pool (WAPP) transmission line that will extend through Liberia from Ivory Coast. These alternatives have the potential to significantly reduce backbone construction costs on these routes (the WAPP line may be particularly attractive). These savings and routes have not been included in the cost estimates in this appendix.

A preliminary assessment of the program indicates that, while the overall program is estimated to be financially and economically viable, not all individual components are viable on their own without subsidies. Specifically, the overall program exhibits a baseline financial internal rate of return of about 15% and economic internal rate of return of 28%; whereas the financial internal rate of return for the CCL, CBN, and RAN are 30%, 4%, and -2%, respectively. These results, although preliminary, are relatively robust across a range of likely input assumption variations.

A preliminary review of the different ownership and business approaches concluded that (i) a private public partnership, similar to CCL (and possibly led by CCL acting as the vehicle for future Internet capacity distribution projects), may be an optimal model for the CBN, and (ii) tendering components of the CBN and the RAN to the private sector on a minimum subsidy basis may be optimal for the rural service extensions (by region or nation-wide). GoL Telecom Act 2007 and National ICT Policy 2010 mandates the establishment of a Universal Access Fund, which is expected to be founded via new regulations developed by LTA on an expedited basis.

A preliminary risk assessment identified the usual risks of: (i) construction delays and cost overruns for the networks (including O3b), (ii) lack of demand due to general economic failure or a lack of economic recovery, and (iii) inappropriate business models and/or an ineffective regulatory regime. The fiber optic cable route construction cost estimates in this planning document are particularly vulnerable to error as they have been made without formal route planning, preliminary route surveys, nor local information on the river crossings required. An important risk mitigation strategy may be to encourage the mobile operators in the near term to exploit their existing microwave systems and thereby begin opening the rural county internet markets.

2. INTERNATIONAL CONNECTIVITY

As noted earlier, the decision to proceed with ACE as the preferred submarine cable landing has already been made. The basis for this decision was presented in “Preliminary Report - Rapid Assessment of ACE Cable Consortium Participation,” Ministry of Planning and Economic Affairs, USAID Governance and Economic Management Assistance Program and Liberia Improved Budget and Assets Management Project, 2010-03-24. It is understood that the ACE landing station in Liberia will include an internet exchange point (IXP) to keep national IP traffic internal and to avoid the cost and performance degradation of foreign transit.

3. SECONDARY INTERNATIONAL LINKS

In the longer term, a second (redundant) diverse international route will be essential for network reliability and security. Today this route diversity is provided by multiple earth stations operating on different transponders and different satellites. After a submarine cable landing is in place, some of these satellite links should be maintained as backup.

As noted in the Situation Analysis Appendix, there is also an existing UNMIL microwave system linking Monrovia with the SAT-3 cable in Côte d'Ivoire. As UNMIL demobilizes, this radio link can be used as a backup international link (as well as a component of the national backbone).

An interesting option would be to deploy an O3b terminal as the secondary international link since O3b has the capability of also providing nation-wide links to the county capitals. O3b and this approach is further described and investigated below.

In the longer term, terrestrial links to other cable landing points will become viable as the national network reaches the borders with neighbouring countries that land other cables. Given the current situation, since Côte d'Ivoire already has a SAT-3 cable landing and the UNMIL radio link already reaches this landing station, it would be a good choice. Joint fiber builds with the West Africa Power Pool (WAPP) could also lead to interconnection with neighbouring countries. In a more distant longer term, and as demand warrants the capacity, a second landing point in Liberia will be justified.

4. ACE COST ESTIMATE

A capital and annual operating cost estimate for ACE is summarized in Table 36. These costs are based on preliminary ACE information made available to the Consultants by GoL. Note that a place-holder cost has been included for an Internet Exchange Point (IXP). These costs are summarized here because ACE and the Cable Consortium of Liberia (CCL) are factored into the overall broadband connectivity program business case developed later in this appendix.

#	Parameter (units)	Note	Value
1.0	General		
1.1	Initial capacity (Gbps)	N1	5.3
1.2	Capacity increment size(Gbps)		5.3
2.0	Capital cost estimate (\$M)	U/C Qty	Total
2.1	ACE capital cost contribution	25 1	25
2.2	Associated non-ACE costs	2 1	2
2.3	Internet exchange point (IPX)	0.2 1	0.2
2.4	Project contingency	2 1	2
2.5	Expansion cost per 5.3 Gbps	5 TBD	
2.0	Operating cost estimate	U/C Qty	Total
2.1	Annual amount, based on % of capital (\$M)	1.8 1	1.8
2.2	Percent of capital to use for above estimate	6%	
Notes:			
N1 Assumes 42 STM-1 with 63 E1 each (42x63x2Mbps=~5.3 Gbps).			
[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]			

Figure 42. African Coast to Europe (ACE) Submarine Cable System, Capacity Parameters, and Budgetary Cost Estimate. (U/C=Unit Cost in USD; and Qty=Quantity)

5. MONROVIA CONNECTIVITY

As noted in the Situation Analysis Appendix, Libtelco, four mobile operators and a hand full of ISPs serve the dense Monrovia market. The existing networks are radio-based and generally optimized for legacy GSM traffic. The Libtelco CDMA network is the exception -- this is a third-generation (3G) digital network that has reasonable data traffic handling capability. It is noted that the mobile operators face an expensive upgrade to their base stations and backhaul networks to move to next generation, data-optimized networks (e.g., 3G/4G). They will also need more spectrum.

In discussions with three of the four operators⁴², network upgrades for improved data service capability will be justified when low-cost high-capacity global internet service is made available through the cable landing. Upgrade costs will involve base station equipment and backhaul network, and may be on the order of a few hundred thousand dollars per cell site. The costs depend on the degree of non-radio related improvements that may also be undertaken (power, tower, etc.). It was also noted that Libtelco has secured funds and is in the process of awarding a contract to build a fiber optic network for Monrovia.⁴³ Libtelco has identified at least one government department as a commercial customer. There are also several ISPs active in the Monrovia area with significant design and deployment capability⁴⁴. The

⁴² 2010-04-15 / 1000-1130, Lonestar, Francois Joubert, Chief Executive Officer, Nathaniel Kevin, Regulatory Consultant: Meeting with LTA in attendance (Madame Chair and Commissioners) to discuss (i) ACE and (ii) nation-wide distribution of ACE capacity.

2010-04-16 / 1115-1200, Comium, Chadry Salim, Business Manager (heads replacement management team), Abdallah Nassar, Technical Director: Meeting to discuss (i) ACE and (ii) nation-wide distribution of ACE capacity.

2010-04-16 / 1600-1700, Cellcom, Abraham Avi Zaidenberg, Executive Managing Director, Tzahi Asulin, Chief Technical Officer: Meeting with LTA (Mr. Howard) to discuss (i) ACE and (ii) nation-wide distribution of ACE capacity.

⁴³ 2010-04-08 / 1500-1545 LISGIS, Lamane Kamara and ICT staff: Received briefing on information available and learn that formal request is required.

2010-04-13 / 1230-1400, Libtelco, Ben Wolo, Managing Director and Vernon Scott, Director of Security and Assets: Meeting to obtain information on current situation of pre-war radio site assets.

⁴⁴ 2010-04-12 / 1430-1600, NAS Inter-Global, Mr. Philip Parker: Meeting to discuss ISP association.

Monrovia data and internet access market has sufficient density to support a competitive service provider environment.

Although rolling out broadband services will spectrum and require significant operator investments, we conclude that, based on discussions with the operators and our assessment, the Monrovia market is sufficiently large and competitive that no special incentives or provisions are necessary. That said, it is important to avoid any dis-incentives that may impede the natural development of the Monrovia data and internet market by a competitive private sector.

6. COUNTY CONNECTIVITY

Each county capital forms a political administrative hub, and each can be expected to also form a communications hub. As a reference design for a network to reach the county capitals, a network point of presence (PoP) is assumed to be formed in each capital. The PoP will provide capacity that can be distributed within the capital by fiber optic cable or radio (both point to point and multi-point, such as WiMAX or 3G/4G mobile). Which ever is most economical and/or favored by the operator will be used. Today, in nearly all county capitals there is mobile operator competition, therefore distribution within and around the capital is not included in the scope of the county network.

In terms of transmission system technology, connectivity options to provide data and internet capacity to the county capitals include (i) upgrade and extension of existing microwave radio systems, (ii) upgrade and expansion of existing VSAT terminals, (iii) O3b satellite terminals and service, and (iv) fiber optic cable. Each of these options are briefly described, assessed, compared, and conclusions drawn.

6.1 Microwave Radio

As noted earlier, the mobile operators have microwave networks along major corridors and reach many of the county capitals terrestrially. These radio systems, although adequate for GSM mobile service, do not have the capacity to meet the long term demand for carrying broadband data, which will exceed 100 Mbps on every communication corridor to the county capitals (the 2016 traffic forecast in Table 37 substantiates this). Typically these radio systems are based on increments of E1 (i.e., 2 Mbps) -- specifically 16, 32, 64, and 128 Mbps. Often the lower capacity radios can be increased to the highest capacity -- although if the original system was not designed for high capacity, then larger antennas, dual polarity antennas, more antennas, or in the worst case, additional sites may be required (at a cost of several hundred thousand dollars per additional site). Beyond 128 Mbps, additional radio channels may be added (each with 128 Mbps capacity), typically at a cost of about USD 50,000 to 90,000 per radio channel per hop. Nominally a maximum of eight channels may be added in a frequency band (beyond which additional antennas are required), which brings the total system capacity in a band to about one Gbps.

Newer classes of IP radio optimized for next generation cellular base station backhaul can achieve higher capacities (up to 1 Gbps in a 56 MHz channel using both polarities) on shorter hops; however on long distance transport networks where hops are longer and carrier class reliability is required, capacities are commensurately lower. In addition to radio costs, additional power at the site will also likely be required. Assuming a 50 km average hop length, over building a radio system to maximum capacity will cost on the order of USD 10-20 thousand per kilometer. This approaches the same order of cost as laying fiber-optic cable -- a media with capacities on the order of hundreds of Gbps or even Tbps. For service affordability, transmission systems should have operational life spans of 10 to 20 years. Significant investment should therefore be made on facilities with the capacity to support service across this time frame.

County	2016	2020
Bomi	141	811
Bong	501	3,214
Gbarpoku	118	692
Grand Bassa	331	2,047
Grand Cape Mount	174	1,041
Grand Gedeh	194	1,239
Grand Kru	110	523
Lofa	388	2,563
Margibi	344	2,282
Maryland	205	1,351
Montserrado	2,174	14,822
Nimba	643	3,994
River Gee	116	645
Rivercess	104	570
Sinoe	167	898
This forecast assumes the availability of good quality and affordable internet access.		

Figure 43. Total Traffic Demand Forecast by County in 2016 Including Capital, Districts, and Clans

Note that supply constraints mean that this demand will not be satisfied in this time frame.

In summary, the existing microwave system assets may be exploited to rapidly extend some capacity to the counties; however to achieve long term economies of scale, they will eventually need to be replaced by a fiber-optic cable based national backbone network. In the longer term, these microwave systems (or upgraded versions of them) will continue to be useful for distributing capacity out from the capitals to the rural district and clan headquarters.

6.2 VSAT

VSATs are currently deployed by the mobile operators at some of the remote county capitals. As noted earlier, at some \$3-\$7 thousand per Mbps per month, the high cost of satellite capacity, especially over the long term, means that as demand increases, it will become necessary to deploy facilities with lower cost per megabit per second to avoid limiting demand due to affordability. Therefore VSATs are interim solutions until lower-cost scalable facilities can be deployed. As noted earlier, VSATs will have a network backup role to play until route diversity can be provided to assure network reliability (in particular, fiber optic networks require route diversity for high availability).

6.3 O3b Satellite

In 2008 a new medium Earth orbit satellite communications initiative was announced -- O3b. This initiative proposed satellites in an equatorial orbit at 8,000 km which can achieve “fiber-like” performance with delays under 130 ms. If this project stays on the current schedule, eight Ka band satellites will launch to commence service in 2012 with about 10 Gbps of total capacity. Another eight satellites should launch a year later to complete the constellation. This is hailed as a potentially “disruptive” satellite technology for Africa. Ob3 stands for the “other 3 billion” who do not have viable access to the internet. The intent is to provide high capacity and low latency network capacity to ISPs. The bandwidth is available in increments of 155 Mbps.

This technology can be used for both international connectivity and nation-wide connectivity to major traffic concentrations -- e.g., the county capitals. For national connectivity, a full transponder commitment is required. A full transponder can theoretically deliver up to 450 Mbps downlink and 300 Mbps uplink,

committed rates for practical deployments may be on the order of 300 Mbps downlink and 100 Mbps uplink.

Essentially the O3b satellite system can provide capacity from the capitals to Monrovia as well as capacity from each capital directly to the global internet (via a Tier-1 ISP in Spain). Specifically, the ability of O3b to form beams with a diameter of approximately 600 km may be exploited by Liberia for rapidly deploying this shared capacity across all county capitals (note that the maximum span across Liberia is approximately 550 km). This would require an O3b Tier 1 IP Trunking Terminal in Monrovia (that can serve double duty as a hub for the county network as well as a backup for the international gateway) and O3b Remote Terminals in each of the 14 county capitals (the capital of Montserrado, Bensonville, is sufficiently close to Monrovia to be served by terrestrial facilities -- e.g. microwave then fiber). The cost of the Monrovia hub can be avoided by landing the national traffic in Europe at the O3b teleport and backhauling on ACE to Monrovia⁴⁵. As traffic builds, the Monrovia hub can be deployed. Table 38 provides indicative unit costs for O3b.

#	Parameter (units)	Value
1.0	Tier-1 IP Trunk Terminal, Monrovia	
1.1	O3b capital expenditures (\$K)	300
1.2	Support facility capital expenditures (\$K)	200
1.3	Estimated power consumption (kW)	10
2.0	Remote Terminal, each county capital site	
2.1	O3b capital expenditures (\$K)	35
2.2	Support facility capital expenditures (\$K)	65
2.3	Estimated power consumption (kW)	2
3.0	Annual operating expenditures	
3.1	O3b space segment, transponder and beam (\$K)	4,500
3.2	Central site maintenance, Monrovia (\$K)	25
3.3	Remote site maintenance, each capital (\$K)	5
3.4	Central site power, Monrovia (\$K)	43.8
3.5	Remote site power, each capital (\$K)	8.8
4.0	Assumptions	
4.1	Annual maintenance cost as a % of capital (%)	5%
4.2	Maximum O3b downlink capacity (Mbps)	290

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 44. Indicative Unit Costs for an O3b Satellite Based Network to the County Capitals

It is noted that O3b does not have the potential economy of scale to reach the sub USD 1,000 per duplex Mbps that can be achieved with a submarine cable. These factors are considered necessary for deep market penetration. In short, it is not a replacement for a submarine cable landing and high capacity national backbone.

With funding from Google, Liberty Global and HSBC the initiative has credibility. Despite the high profile backers, lingering questions remain concerning their ability to raise sufficient capital for launch. A satellite supplier has been identified (Thales Alenia Space) and satellites are under construction (Preliminary Design Review of the satellites was completed February, 2009). In March 2010 a contract was signed with ViaSat Inc. for the production and installation of Ka-band infrastructure. This is an initiative to watch, while remembering that Africa has seen its share of failed experiments and cancelled communication projects.

⁴⁵ Email from E. Kariningufu to D. Sharp re "Conference call - Additional Traffic Information," with attachment sent 2010-07-02.

6.4 Fiber Optic Cable

As noted earlier, since the long term route capacity will exceed 100 Mbps to each county capital, fiber optic cable is the most cost-effective solution. It should also be noted that for reliability, fiber-optic networks require route or media diversity (i.e., either a separate route as in a ring topology, or microwave or satellite backup). If the backup link is not high-capacity fiber optic cable, then during a cable outage event only high-priority traffic can be carried over the limited capacity backup links. Therefore in the longer term, fiber-optic network rings and/or meshes should be formed. Until rings are formed, some satellite or terrestrial microwave backup should be kept in place.

Considering existing population and economic activity, as well as expected development, a preliminary fiber optic network design was cast as a reference for estimating costs and setting up a possible phased implementation. This reference design is shown in the figures below.

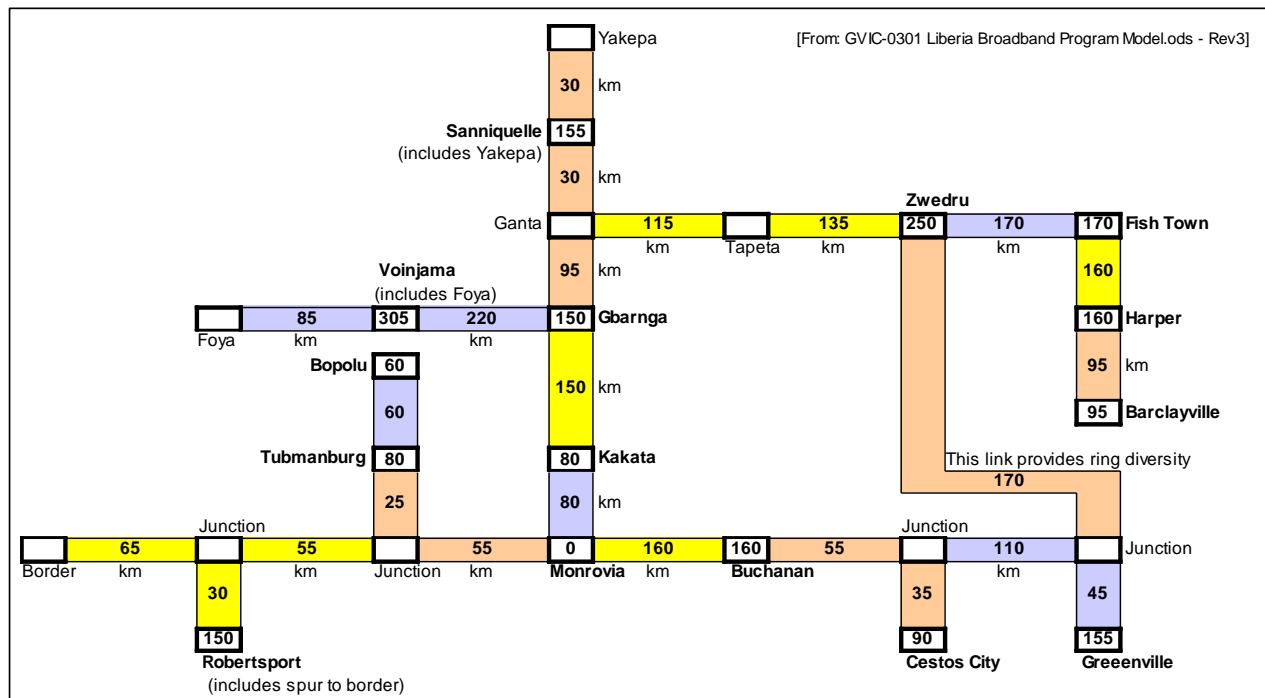


Figure 45. Routing Plan for County Backbone Fiber Optic Network (Provisional Reference Design). The Route Kilometer Estimates Are Based on Manual Measurements from a 1:600,000 Scale Road Map with a 20% Margin Added to Compensate for Scale and Measurement Simplification.

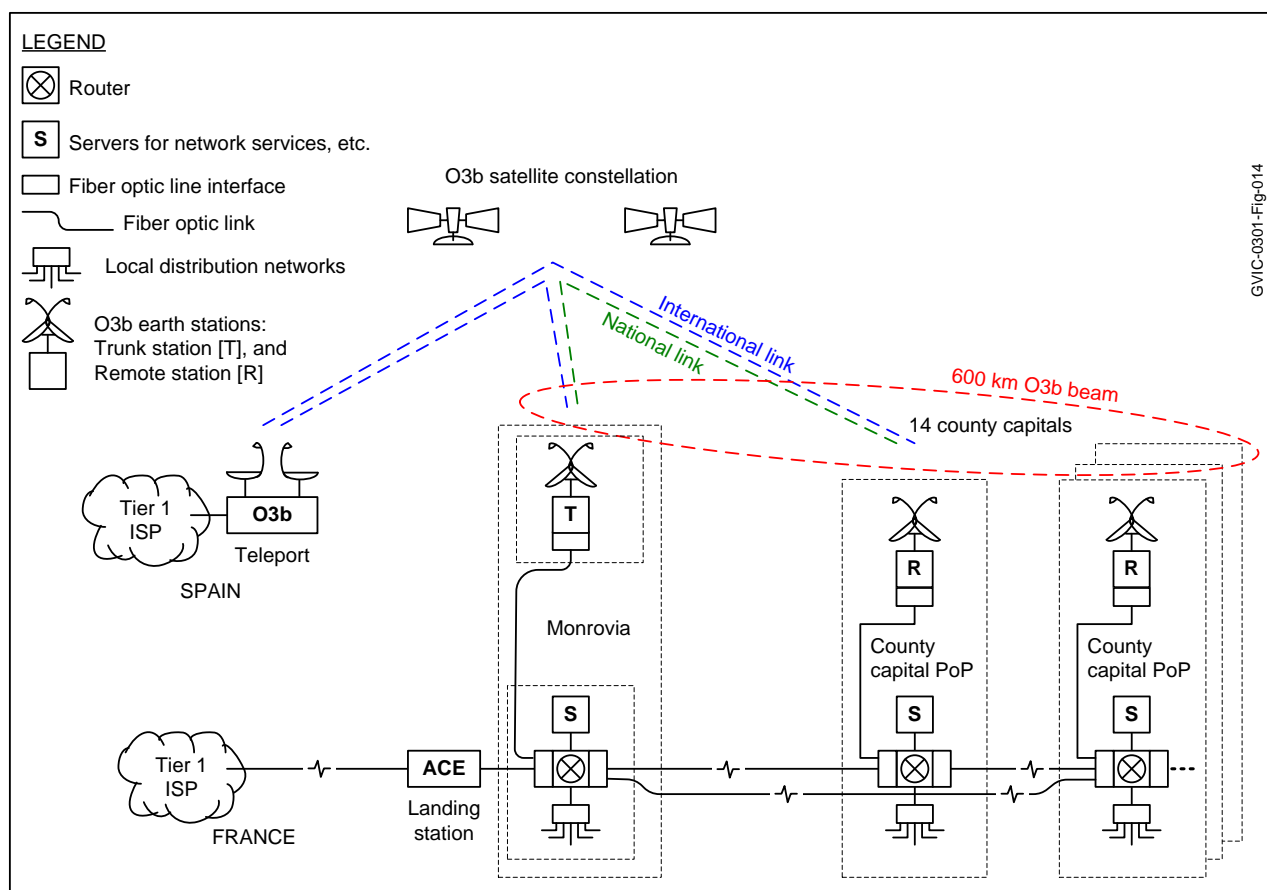


Figure 46. Concept Diagram for County Capital Fiber Optic Backbone Network Architecture

The figure below provides indicative unit costs for estimating the cost of a fiber optic network to the county capitals. These costs are rough order of magnitude and are accurate only to within plus/minus 50%. In particular, the cost to construct and maintain river crossings in a high rainfall climate must not be underestimated.

#	Parameter (units)	Value
1.0	Fiber optic cable routes	
1.1	Capital cost, installed, normal (\$K per km)	25
1.2	Capital cost, installed, difficult (\$K per km)	35
1.3	Annual cable maintenance cost as % of capital	2.5%
2.0	Fiber optic cable - line termination allowance	
2.1	Capital cost for interfaces (\$K per 100 Mbps)	10
2.2	Annual interface maintenance cost as % of capital	10%
3.0	County point of presence (PoP), each PoP	
3.1	Capital cost for equipment, installed (\$K)	75
3.2	Capital cost for support facilities (\$K)	225
3.3	Power consumption (kW)	5
3.4	Annual maintenance cost as % of capital	5%
3.5	Annual cost for power (\$K)	21.9

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 47. Indicative Unit Costs for A Fiber Optic Network to the County Capitals

There are opportunities to minimize costs through joint cable route construction with the Liberia Electric Corporation (LEC), mining concessions, and public works road crews. The potential costs savings are significant as installation costs are typically more than the cable supply cost. In particular, the proposed West Africa Power Pool (WAPP) high-voltage transmission line from Yakepa to Sierra Leone via Buchanan and Monrovia should be pursued⁴⁶ because it has the potential to reduce the cost of the build from Monrovia to Sierra Leone and Monrovia to Buchanan on the order of USD 2-3 million. Joint planning and construction across sectors requires considerable coordination and effort.

7. OPTIONS ANALYSIS AND COMPARISON

The figure below provides a summary assessment and comparison of each option discussed above.

Summary assessment of network options to the county capitals.	
Option	Advantages / Disadvantages
Microwave radio systems	<ul style="list-style-type: none"> + Useful for rapid extension of moderate amounts of capacity if existing systems are upgraded or overbuilt. + Useful for interim backup and for distribution of capacity out from county capitals. - Insufficient capacity for long-term backbone.
VSAT	<ul style="list-style-type: none"> + Low capital costs. + Useful for interim backup. - High recurring cost for capacity. - Ku band is subject to rain induced impairments.
O3b satellite	<ul style="list-style-type: none"> + Relatively low capital costs. + Moderate recurring cost for capacity on a per Mbps basis. + Can provide capacity from county capital to Monrovia as well as to the global internet. - At least a full transponder of capacity is required for a national beam; which is relatively expensive; especially if it cannot all be used. - Not available until 2012 or 2013. - Ka band is subject to rain induced impairments.
Fiber optic cable network	<ul style="list-style-type: none"> + Low recurring cost per megabit per second for high-capacity routes. + The fiber-optic cable has a long useful life (15 to 25 years). + Very high capacity. - High capital costs. - Back up link required for reliability.

Figure 48. Summary Assessment and Comparison of Each Option

⁴⁶ 2010-04-20 / 1530-1630, Joseph Mayah, Acting Managing Director, Liberia Electricity Corp.: Meeting to discuss plans for re-establishing the national electric grid, and areas of mutual interest.

The summary assessment in the table leads to technical conclusions that: (i) existing microwave assets may provide initial capacity; (ii) 03b may provide viable connectivity for the county capitals until a fiber optic network is built; (iii) in the long term, a fiber-optic network will be required to cost-effectively meet capacity needs; (iv) existing microwave and VSAT facilities will be necessary for network reliability until fiber-optic rings can be formed; and (v) even after a high capacity national backbone is deployed, existing microwave system can continue to be used to distribute connectivity out from the county capital PoPs.

8. REFERENCE DESIGN

A reference design was developed based on: (i) the above long term network connectivity conclusions, (ii) the system architecture concept shown in Figure 38, and (iii) the routing plan from Figure 39. Exploitation of existing microwave system facilities are not considered within the context of this design. These systems are nonetheless important in the near term and the operators should be provided with incentives to maximize the economic utilization of these resources.

It should be noted that construction, fiber strand count, and equipment details are not set out in the cable system design. Cable construction may be overhead or underground (trench or plow buried), and as noted above should be joint built with others where applicable. The network architecture may be based on legacy SDH, next-generation SDH, or Ethernet. Decisions on each of these design aspects will necessarily be made based on detailed route and market surveys at the time the projects are planned for implementation. In general, it is expected that the cable will be buried in order to obtain lower maintenance costs in the longer term. Exceptions would be made for joint construction with LEC that may use the shield wire on high-voltage transmission lines (using OPGW cable) or all-dielectric self-support (ADSS) type cable on lower voltage lines. It is also generally expected that the network architecture will be Ethernet and not SDH-based since there is relatively little legacy traffic and future traffic will be dominated by IP packet communications. For quality of service and security support and to provide traffic segregation for open-access (i.e., use by multiple operators), the fiber-optic network will likely be implemented using multi-protocol label switching (MPLS).

9. COST ESTIMATE

A rough order of magnitude cost estimate of the county capital network was prepared using the above reference design and the indicative costs from the first figure below. The cost estimate is summarized in the middle figure and the last figure depicts capital and annual operating expenditures respectively. Costs to distribute capacity from the PoP to the customers within each county capital are not included, and as noted earlier, is assumed to be competitively provided by operators that have a local presence.

#	Parameter (units)	U/C	Qty	Total
1.0	O3b satellite system			
1.1	Tier-1 IP Trunk Terminal site (\$K)	500	1	500
1.2	Remote Terminal site (\$K)	100	14	1,400
2.0	County PoP	300	14	4,200
3.0	Fiber optic network (\$K)			
	Margibi, Kakata	25	80	2,000
	Bong, Gbarnga	25	150	3,750
	Nimba, Sanniquelle	25	155	3,875
	Bomi, Tubmanburg	25	80	2,000
	Grand Cape Mount, Robertsport	25	150	3,750
	Gbarpoku, Bopolu	35	60	2,100
	Grand Bassa, Buchanan	25	160	4,000
	Lofa, Voinjama	25	305	7,625
	Grand Gedeh, Zwedru	35	250	8,750
	River Gee, Fish Town	35	170	5,950
	Maryland, Harper	35	160	5,600
	Grand Kru, Barclayville	35	95	3,325
	Rivercess, Cestos City	35	90	3,150
	Sinoe, Greenville	35	155	5,425
4.0	Interfaces, link pair per 100 Mbps (\$K)	10	TBD	
Grand total (without project overhead and contingency)				67,400
Note: The number of interface units (optical line drivers) is a function of the required capacity which varies by year and location.				

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 49. Rough Order of Magnitude Base Construction Cost Estimates for the County Broadband Network. (U/C=Unit Cost in USD; and Qty=Quantity)

#	Parameter (units)	U/C	Qty	Total
1.0	O3b satellite system			
1.1	Tier-1 IP Trunk Terminal site (\$K)	68.8	1	69
1.2	Remote Terminal site (\$K)	13.8	14	193
1.3	Space segment (\$K)	4500	1	4,500
2.0	County PoP (\$K)	36.9	14	517
3.0	Fiber optic network maint. (\$K per km)			
	Margibi, Kakata	0.63	80	50
	Bong, Gbarnga	0.63	150	95
	Nimba, Sanniquelle	0.63	155	98
	Bomi, Tubmanburg	0.63	80	50
	Grand Cape Mount, Robertsport	0.63	150	95
	Gbarpoku, Bopolu	0.88	60	53
	Grand Bassa, Buchanan	0.63	160	101
	Lofa, Voinjama	0.63	305	192
	Grand Gedeh, Zwedru	0.88	250	220
	River Gee, Fish Town	0.88	170	150
	Maryland, Harper	0.88	160	141
	Grand Kru, Barclayville	0.88	95	84
	Rivercess, Cestos City	0.88	90	79
	Sinoe, Greenville	0.88	155	136
4.0	Interface maintenance as % of capital	10%		
Grand total (without contingency)				6,823
Note: The number of interface units (optical line drivers) is a function of the required capacity which varies by year.				

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 50. Rough Order of Magnitude Annual Operating Expenditure Estimates for the County Broadband Network. (U/C=Unit Cost in USD; and Qty=Quantity)

The capital costs are base construction costs and do not include project overheads and contingency. Project overheads include allowances for planning and engineering, right-of-way and land acquisitions, equipment spares, test equipment, network management systems, training, contract administration, and project management. Project overheads can add between 10% and 30% or more to the base construction cost. Price and physical contingency should be included for possible price escalations (e.g., foreign exchange fluctuations, changes in competitiveness) and for omissions and/or changes (e.g., errors in conditions or requirements).

Depending on the class of estimate and level of risk, contingencies of 5% to 20% are typical. Project overhead and contingencies are factored into the estimate as the business case is developed in a later section of this appendix. From these calculations, the total capital investment for the county backbone network is estimated to be in the range of \$6 to \$10 million for an O3b deployment (including network PoPs in each capital) and \$60 to \$120 million for the fiber optic cable network.

10. IMPLEMENTATION OPTIONS: COUNTY NETWORK

The above analysis provides a reference design and cost estimate for an O3b medium term and fiber optic network long term to serve the county capitals. In addition, if the UNMIL microwave system becomes available for shared use, then this will also need an operator. Given the overall high costs and the need for the backbone to be shared as an open-access network, this raises the question of who should build and operate the facilities. There are four main options available: (i) a public sector operator (i.e., Libtelco, the designated national operator prior to privatization); (ii) a private sector operator; (iii) a group of private sector operators; and (iv) public private partnership (PPP). The following discussion examines each of these approaches. It should be noted that it is assumed that each operator with existing microwave routes in Liberia would independently take steps in the near term to leverage these assets.

Option A: Public operator builds the network: Libtelco would be the logical candidate as they are currently owned by the GoL and Libtelco has existing properties from the pre-conflict national backbone radio system that may be useful as PoPs and tower co-location sites. As noted earlier, although many of the buildings and towers were damaged and destroyed during the conflict, they are nevertheless valuable assets -- some are currently being leveraged by the mobile operators. Disadvantages of this approach include (i) poor policy fit (does not exploit the private sector) and (ii) Libtelco does not have ready access to capital to fund construction of this network (other than possibly through supplier credits which can result in be non optimal long-term investment decisions).

Option B: A private sector operator builds the county backbone network: At least three of the mobile operators already have significant microwave radio systems. Arguably, only Lonestar has the market share to undertake such a network on its own. It should be noted that this network has not been built yet because, without an affordable international connection to the global internet, there is no need -- the existing radio networks are adequate to meet current GSM (2G cellular mobile) demand. Unfortunately, if the backbone is built by a single operator, there is a risk of predatory pricing; and if this operator has significant existing market share, this would constrain sector development. It may be wise to pre-empt such a move by facilitating an initial network build that can be shared by the operators on a non discriminatory basis.

Option C: A group of operators build the network: In theory, a group of operators could band together to build the network. The advantage of this approach is that being private sector led, it is a good policy fit. The disadvantage is the likelihood of it working -- as competitors with unequal capacity, cooperating on a major capital expenditure is not easy. The effort to form an operator consortium for ACE testify to the difficulty. Therefore this approach is set aside as impractical.

Option D: A public private partnership (PPP) builds the network: Similar to the proposed ACE cable consortium (i.e., CCL), the network could be led by a PPP. If CCL is successfully formed to hold the Liberia membership in ACE, then CCL could theoretically also be the vehicle to construct and operate the

Network. If a new entity is preferred, then the PPP can be formed in two ways: (i) the government leads the initiative by directly organizing the PPP with Libtelco as the public entity, or (ii) the government competitively tenders for private sector participation.

Given the current situation, including time constraints (e.g., the need to move in advance of the 2012 cable landing in-service data), the former is the preferred option. The advantages of this approach include time to market, Libtelco's contribution can include access to existing properties and facilities, the creation of an open access operator neutral platform, and the experience forming the CCL for the ACE cable landing can be leveraged (either directly by using CCL or indirectly to form a complementary PPP). Depending on the structure of GoL's participation in CCL, if it is structured so that GoL obtains proceeds from a later sell-down of its position to other operators, then a portion of GoL's proceeds of sell-down could be used to fund a component of this initiative via PPP. The disadvantages of this approach include the effort to form the PPP, and the need to reduce the "public" part over time to zero.

Not mentioned specifically, but considered to be inherent in each of these options, is the desirability of working with LEC, mine concession holders, and the Ministry of Public Works (relating to road construction).

From the above discussion, it is evident that a PPP is the preferred alternative. This solution was also identified as the preferred approach in discussions with the mobile operators⁴⁷.

11. CONNECTIVITY STRATEGY

In support of the overall objective of extending broadband connectivity to the county capitals, and considering the above technology and implementation options and conclusions, the following strategies are identified:

1. Create a suitable PPP vehicle to provide the county broadband network (e.g., similar to the CCL for ACE).
2. Identify and implement any necessary incentives to create near and medium term viability, for both the PPP and to motivate individual operators to exploit their existing terrestrial microwave routes.
3. Through the PPP, consider an UNMIL based microwave solution in the near term, and consider an O3b solution to the county capitals for the post 2012 time-frame.
4. Through the PPP, plan a phased deployment of a national fiber-optic network to all county capitals, and construct this network in phases, possibly funded in part by GoL proceeds of sale to other operators of its participation in CCL prior to launch of ACE service.

Refer to the funding and financial analysis sections below for an assessment of sources for funding and overall economic viability. The timing for network build-out will depend on various factors including: availability of funding, build up of demand, and the time to plan and construct fiber routes. The timing is considered further in the program formulation and viability section later in this appendix.

⁴⁷ 2010-04-15 / 1000-1130, Lonestar, Francois Joubert, Chief Executive Officer, Nathaniel Kevin, Regulatory Consultant: Meeting with LTA in attendance (Madame Chair and Commissioners) to discuss (i) ACE and (ii) nation-wide distribution of ACE capacity.

2010-04-16 / 1115-1200, Comium, Chadry Salim, Business Manager (heads replacement management team), Abdallah Nassar, Technical Director: Meeting to discuss (i) ACE and (ii) nation-wide distribution of ACE capacity.

2010-04-16 / 1600-1700, Cellcom, Abraham Avi Zaidenberg, Executive Managing Director, Tzahi Asulin, Chief Technical Officer: Meeting with LTA (Mr. Howard) to discuss (i) ACE and (ii) nation-wide distribution of ACE capacity.

12. RURAL CONNECTIVITY

Providing data and internet capacity to the rural areas outside the county capitals, and other major urban centers on the fiber network, will likely need to be considered in two stages: first extend the network to district headquarters, and then extend it to the clan headquarters. Technology options for these extensions include (i) point to point microwave radios, (ii) point to multi-point radio, (iii) VSAT, and (iv) fiber optic cable. Each of these options are briefly described, assessed, and conclusions drawn.

12.1 Point to Point Microwave Radio

Point-to-point radios can be used to spur out from the county PoPs to the districts. In general point-to-point radios make sense when capacity requirements are sufficiently high (e.g. typically 50-200 Mbps) and/or there are only a limited number of links emanating from the PoP (e.g., typically one to three). This type of radio is often used as a backhaul for point to multipoint radio base stations sites, such as for WiMAX and cellular mobile. The radio may be in a license-exempt or licensed frequency band, and may be deployed in a non-protected or protected (hot standby) equipment configuration. The choice requires a cost versus reliability trade-off. License-exempt and/or unprotected configurations are generally not considered to deliver carrier class reliability, as the links are subject to interference from other unlicensed users, and the lack of equipment redundancy means there are single points of failure. The figure below provides indicative costs.

As noted in the above section on county connectivity, the existing mobile radio network assets are expected to be leveraged to extend capacity to the areas adjacent to the county capitals and along the existing microwave routes.

#	Parameter (units)	Value
1.0	Capital cost per link pair with antennas, installed	
1.1	License exempt, non-protected, 50 Mbps (\$K)	40
1.2	License exempt, non-protected, 100 Mbps (\$K)	50
1.3	Licensed band, hot standby, 50 Mbps (\$K)	100
1.4	Licensed band, hot standby, 100 Mbps (\$K)	120
2.0	Annual operating costs per link pair	
2.1	License exempt, non-protected, 50 Mbps (\$K)	3.5
2.2	License exempt, non-protected, 100 Mbps (\$K)	4
2.3	Licensed band, hot standby, 50 Mbps (\$K)	8
2.4	Licensed band, hot standby, 100 Mbps (\$K)	9
4.0	Assumptions	
4.1	Annual maintenance cost as % of capital	5%
4.2	Non-protected radio link power consumption (kW)	0.34
4.3	Hot standby radio link power consumption (kW)	0.7
4.4	Cost per kWh for electrical power (\$)	0.5

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 51. Indicative Unit Costs for a Point-to-Point Radio Systems; Radios and Antennas Only, No Allowance for Support Facilities

12.2 Point to Multi-point Radio

Point to multi-point radio is the only logical choice for “last-mile” access where customers (i) are in a 10 to 30 km diameter cluster, and (ii) and require average design point (e.g., busy hour) capacity on the order of tens to hundreds of kilobits per second and burst capacities on the order of megabits to tens of megabits per second. Open standards-based technologies that have achieved high volume deployment are necessary to avoid early obsolescence risk. This means the choice will be WiMAX or 3G/4G cellular mobile. The choice between these will depend on spectrum holdings and/or spectrum availability and cost, as well as the operator's preference. The system vintage or generation will depend on what is current and competitive in the marketplace at the time of procurement.

The figures below illustrate the general architecture to district and clan level from the county PoP or a PoP that is situated on the county network fiber backbone. Note that point-to-point radio will typically be used for backhaul from district headquarter base station sites, and point-to-point radio or relay links may be used to the clan level, depending on capacity requirements. The final figure below provides indicative costs.

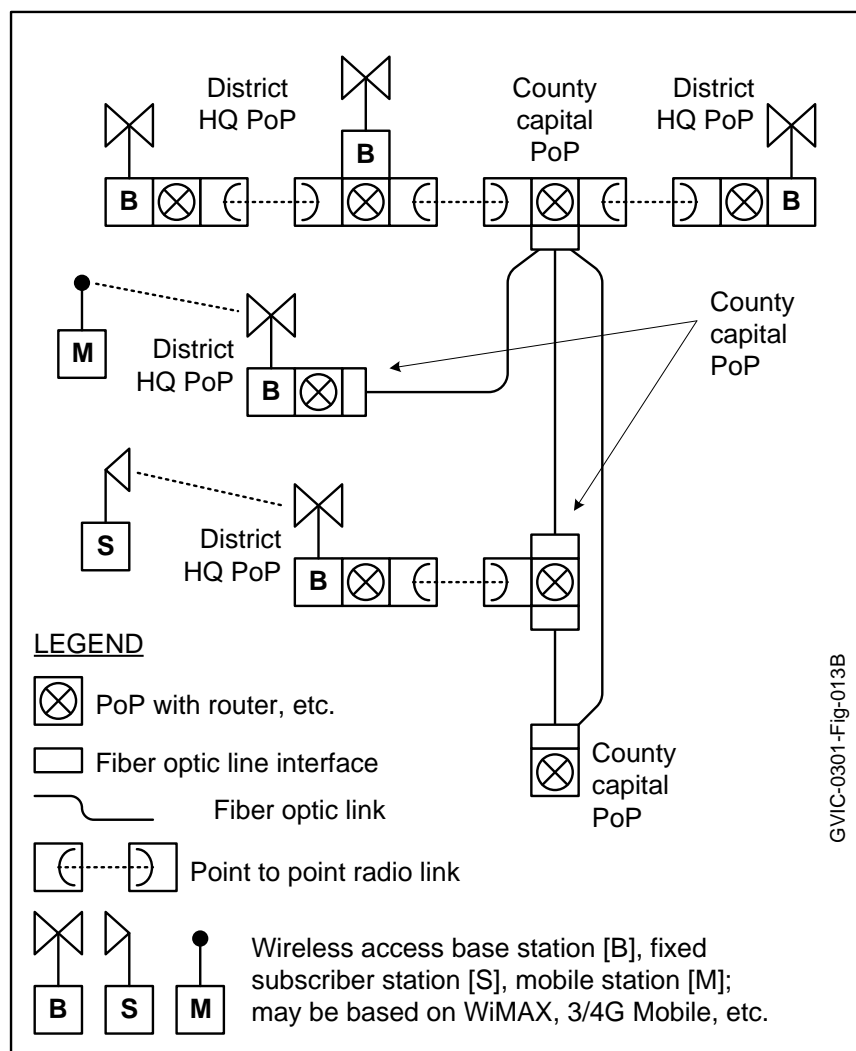


Figure 52. Concept Diagram for Rural Access Network Architecture, County Capital to District Headquarter Extension

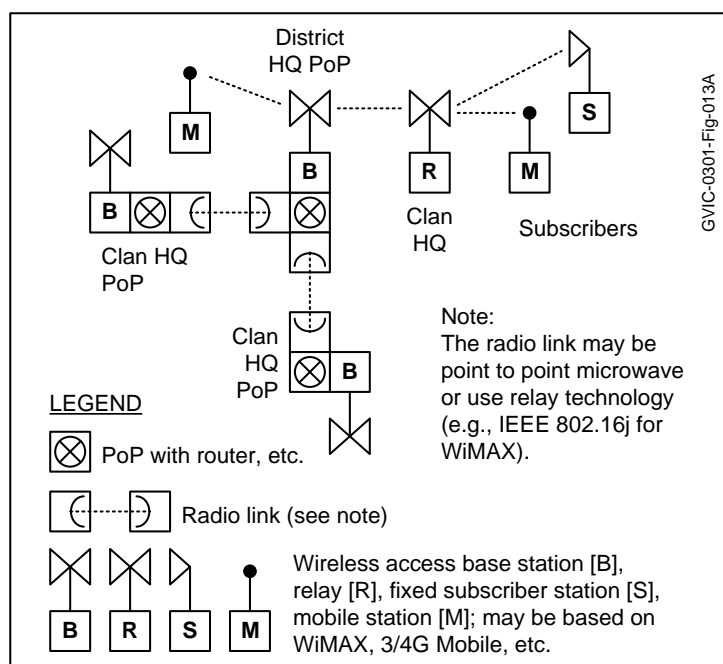


Figure 53. Concept Diagram for Rural Access Network Architecture, District Headquarter to Clan Headquarter Extension.

#	Parameter (units)	Value
1.0	Base station base construction cost with antennas, installed	
1.1	Base station, 2-branch diversity, 3 sectors (\$K)	76
1.2	Base station, 1 sector no, diversity (\$K)	24
1.3	Relay station, 1 sectors (\$K) [N2]	36
1.4	Fixed subscriber station, installed with mast (\$K)	0.8
2.0	Annual operating costs per link pair	
2.1	Base station, 2-branch diversity, 3 sectors (\$K)	7.2
2.2	Base station, 1 sector no, diversity (\$K)	4.1
2.3	Relay station, 1 sectors (\$K) [N2]	4
2.4	Fixed subscriber station, installed with mast (\$K)	0.05
4.0	Assumptions	
4.1	Annual maintenance cost as % of capital	6%
4.2	Base station power consumption, 3 sector (kW)	0.6
4.3	Base station power consumption, 1 sector (kW)	0.2
4.4	Relay station power consumption, 1 sector (kW)	0.3
4.5	Cost per kWh for electrical power (\$)	0.5
[N1] Power for the fixed subscriber station is provided by the customer. The customer may also pay for some or all of the subscriber station capital cost.		
[N2] The relay station does not need a link radio for backhaul.		

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 54. Indicative Unit Costs for a Point-to-Multipoint Radio Systems; Radios and Antennas Only, No Allowance for Support Facilities

As noted earlier in the Situation Analysis appendix, mobile subscriber technology, including WiMAX and 3/4G cellular are the wave of the future. These technologies are driving down the cost of internet access from several hundred dollars for a computer and reliable power source, to a mobile handset for under

\$100 and power needs that can be met with solar and other low infrastructure alternatives (e.g., manual hand crank generators).

12.3 Satellite

VSAT has been used to provide backhaul for 2G cellular mobile base station sites. Although relatively cost-effective for voice circuits, the space segment costs for the capacity to a cell site for broadband access is prohibitive (tens of Mbps). The O3b remote terminals, although having a significant space and power footprint, may have merit in some instances (for example, if deployed early for county backbone duty, then with the arrival of terrestrial fiber rings, these stations become surplus and can be used in more remote locations). A situation that favors satellite would be where two or more terrestrial radio hops are needed between cell sites -- a situation that is not expected to occur often as blanket cellular coverage will generally be needed. There is also a class of Ka band consumer broadband satellite technology available in other regions that, if available, could provide broadband direct to end users. Consumer class broadband with about 1 Mbps downlink and 128 or 256 kbps uplink is offered for \$50 to \$70 per month (capacity is capped by a “fair use” policy to discourage high usage or resale). Unfortunately, this technology is currently unavailable over Liberia. In conclusion, unless the situation changes, satellite is not expected to play a major role for rural access networks, but there may be room for a niche play.

12.4 Fiber Optic Cable

In certain situations, fiber-optic cable can be more cost-effective than radio for cell site base station backhaul. An example is where a string of closely spaced communities are arranged linearly along a right-of-way, such as a road corridor or power transmission line. There are also instances within a community where fiber between a number of closely spaced government or other buildings, may be competitive with radio. However, in general, the high cost per kilometer for fiber installation and the long distances that prevail in the rural access domain, means that fiber will be a niche play.

12.5 Options Assessment

Considering the above discussion, it is evident that the rural access networks will be dominated by radio-based facilities. There will still be some potential for satellite and fiber to be used in a few situations where the conditions are more favorable (cost-effective) to fiber than radio.

12.6 Reference Design

Given that radio will dominate the rural access networks, a reference design was developed based on the system architecture concept diagram in Figure 38 and 39 above. This concept was applied across all of Liberia. Note that placing base stations at 135 district and about 676 clan headquarters (clans in Monrovia and county capitals can be excluded) and assuming 75% of the country is covered results in an average coverage per base station of approximately 100 km², which makes the average rural cell radius about 7 km.

These should be reasonable figures to achieve near full population coverage. The baseline design would deploy over 1000 sectors. Each sector should have at least 5 MHz and preferably 10 or 20 MHz of bandwidth to provide capacity for several hundred customers per sector. This means that the rural operator(s) should have access to a block of 50 to 100 MHz of spectrum, or more. Note that the cost estimates do not include an allowance for a spectrum license fee for the rural network (the rural network is shown later to need an initial subsidy for viability). As noted earlier, rural access was modelled as two construction stages. The first stage builds out to the district headquarters (connecting any clans along the way); then the second stage builds out from the district to cover the clans.

12.7 Cost Estimate

A rough order of magnitude cost estimate to build and operate the rural access networks was prepared using the above reference design and the indicative costs from Table 7 and 8. The cost estimate is

summarized in the figure below for capital and annual operating expenditures. Note that these facilities distribute capacity from the PoP to the end customer.

#	Parameter (units)	U/C	Qty	Total
1.00	Base construction cost per District HQ			232.0
1.01	Licensed band, hot standby, 50 Mbps (\$K)	100	0.5	50.0
1.02	Licensed band, hot standby, 100 Mbps (\$K)	120	0.5	60.0
1.03	Base station, 2-branch diversity, 3 sectors (\$K)	76	1	76.0
1.04	Additional PoP infrastructure	10	1	10.0
1.05	Allowance for tower	25	1	25.0
1.06	Allowance for power	5	1	5.0
1.07	Allowance for equipment shelter	5	1	5.0
1.08	Allowance for land / right of way	1	1	1.0
2.00	Base construction cost per Clan HQ			120.5
2.01	License exempt, non-protected, 50 Mbps (\$K)	40	0.5	20.0
2.02	License exempt, non-protected, 100 Mbps (\$K)	50	0.2	10.0
2.03	Licensed band, hot standby, 50 Mbps (\$K)	100	0.1	10.0
2.04	Licensed band, hot standby, 100 Mbps (\$K)	120	0.05	6.0
2.05	Base station, 2-branch diversity, 3 sectors (\$K)	76	0.1	7.6
2.06	Base station, 1 sector no, diversity (\$K)	24	0.75	18.0
2.07	Relay station, 1 sectors (\$K) [N2]	36	0.15	5.4
2.08	Router, provider edge	10	1	10.0
2.09	PoP infrastructure allowance	8	1	8.0
2.10	Allowance for tower	20	1	20.0
2.11	Allowance for power	3	1	3.0
2.12	Allowance for equipment shelter	2	1	2.0
2.13	Allowance for land / right of way	0.5	1	0.5
3.00	Annual operating cost per District HQ			14.7
3.10	Annual maintenance (\$K)			11.6
3.20	Annual cost for power (\$K)	0.7	kWh	3.1
4.00	Annual operating cost per Clan HQ			9.4
4.10	Annual maintenance (\$K)			6.8
4.20	Annual cost for power (\$K)	0.6	kWh	2.6
Notes:				
[N1] Base construction costs do not include project overhead or contingency allowances.				
[N2] The relay station does not require a link radio.				
[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]				

Figure 55. Rough Order of Magnitude Rural Access Network Assembly Costs for District and Clan Level Extensions. (U/C=Unit Cost in USD; and Qty=Quantity)

These estimates do not include project overheads and contingency. Project overheads include allowances for planning and engineering, right-of-way and land acquisitions, equipment spares, test equipment, network management systems, training, and contract administration, and project management. Project overheads can add between 10% and 30% or more to the base construction cost. Price and physical contingency should be included for possible price escalations (e.g., foreign exchange fluctuations, changes in competitiveness) and for omissions and/or changes (e.g., errors in conditions or requirements). Depending on the class of estimate and level of risk, contingencies of 5% to 20% are typical. Project overhead and contingencies are factored into the estimate as the business case is developed in a later section of this appendix. From these calculations, the total capital investment for the rural access network is estimated to be in the range of \$100 to \$200 million.

It should be noted that the capital and operating costs are significant and the customer densities are low, which will affect viability.

13. IMPLEMENTATION OPTIONS: RURAL ACCESS NETWORK

The above analysis provides a reference design and cost estimate for WiMAX and/or mobile radio-based rural access networks. Given the high cost of facilities and the lower economic density of the rural areas, incentives and subsidies should be expected, at least in the near and medium-term, until economic capacity builds in these areas. Additionally, it should be noted that these networks are to the end customer and only some parts are core infrastructure that competing operators could share. As discussed earlier there are four main implementation options available: (i) a public sector operator; (ii) a private sector operator; (iii) a group of private sector operators; and (iv) public private partnership (PPP). The following discussion examines each of these approaches.

Option A: Public operator builds the rural access networks: Libtelco would be the logical candidate as they are currently owned by the GoL. Disadvantages of this approach include poor policy fit as it does not exploit the private sector and Libtelco does not have ready access to capital to fund construction of these networks.

Option B: A private sector operator builds the networks: At least three of the mobile operators already have some facilities in most of the county capitals. This approach has a good fit with the policy to exploit the private sector; however, incentives and/or subsidies will be needed to create financial viability. This issue is further analyzed later in this chapter.

Option C: A group of operators build the rural networks: In theory, a group of operators could band together to build the networks. However because these networks will serve end customers and customer density is too low to support competition, this approach is impractical.

Option D: A Public Private Partnership (PPP) builds the rural networks: This approach is suited to building infrastructure that will be shared. However, as noted in Option C above, because these networks will serve end customers and customer density is too low to support competition, thus sharing would serve no purpose.

From the above discussion, it is evident that a minimum subsidy tendered competitively to the private sector may be optimal.

13.1 Connectivity Strategy

In support of the overall objective of extending broadband connectivity to the rural area, and considering the above technology and implementation options and conclusions, the following strategies are identified:

1. Form a set of logical county groupings that may be tendered on a minimum subsidy basis to private sector operators for the construction of rural networks and provision of broadband rural.
2. As county capital connectivity is established, decide on the preferred timing and/or priority for tendering.
3. Tender each area to the private sector on a minimum subsidy basis.

APPENDIX 4: BROADBAND CONNECTIVITY PROGRAM FORMULATION

This Appendix defines an overall broadband connectivity program. Consistent with the scope of the demand forecast in the Background appendix, the scope of the technical solutions in this appendix includes public internet and IP network traffic. Existing voice and mobile traffic is not directly considered; however in the longer term, this traffic is indirectly included because internet and IP traffic can be expected to dominate and the facilities for IP traffic will be able to accommodate the existing mobile traffic and its expected growth.

The high capital cost of network infrastructure and ongoing operations necessitates, for affordability reasons, a long cost recovery period. Therefore a long term strategic level development plan is needed. In general terms, the strategy involves an examination of design, implementation, and funding alternatives. The overall strategy is financially and economically justified based on a high level and preliminary analysis. This approach provides a broad strategic or program level basis for action. As applicable, each project within the program will require preliminary and detailed feasibility studies as well as business case preparation.

The following diagram illustrates the network concept for Liberian broadband connectivity:

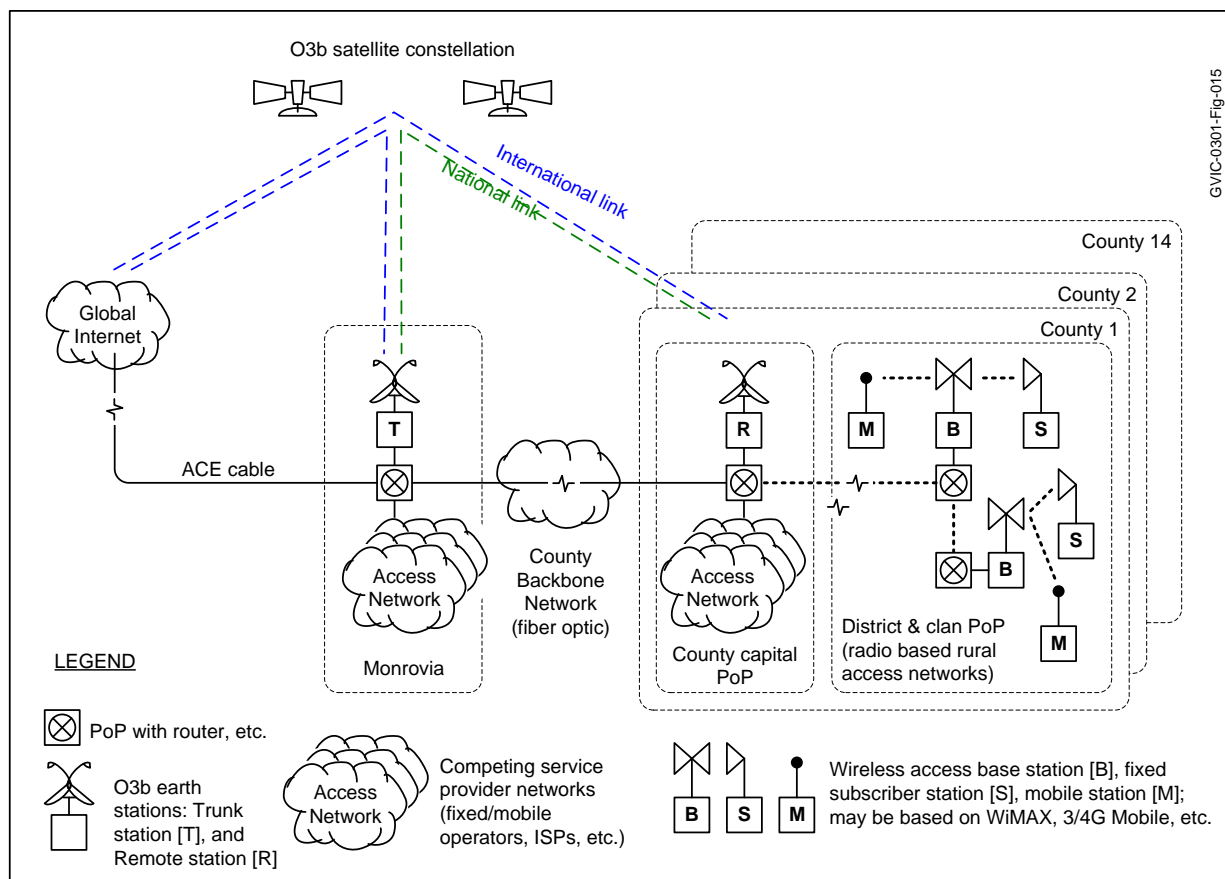


Figure 56. Network Concept Diagram for Liberia Broadband Connectivity

1. PROGRAM PHASES AND NETWORK ROLL-OUT

The overall national connectivity program was arranged into three-year construction phases based on the assumed availability of funding. The funding availability of assumptions are shown in the first figure below. Note that external funds are assumed to be complemented by capital investments available to the network operators working in the sector. The resulting phases are summarized in the middle figure and shown in Gantt schedule form in the last figure.

This roll-out plan should be considered illustrative only. The rural phases were framed more by matching the funding assumptions than by a strict logical grouping. Project feasibility studies will be required to properly frame the phases and roll-out. A critical consideration will be to follow the economic corridor development priorities and LEC's roll-out of the national power grid. The order of development and ability to participate in joint development affects capital costs and demand creation and this, in turn, affects overall program viability.

Phase		External funding sources	Internal funding sources	Total estimated investment
2010	2012	3	4.6	7.6
2013	2015	8	18.2	26.2
2016	2018	10	39.5	49.5
2019	2021	20	57.2	77.2
2022	2024	20	53.3	73.3
2025	2027	5	5.5	10.5
Sum total				244.3
External sources include IFI, GoL, UA Fund, Social Development Funds from Concession Agreements, etc. Internal sources are from network operators including joint operations (e.g., private public partnerships)				

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 57. External Funding Availability Assumptions and Total Investment Requirements (USD Millions)

Phase			Project components			Capital (\$M)
Time frame			County backbone network (CBN)	Rural Access Network - Districts	Rural Access Network - Clans	
1	2010	2012	(O3b satellite network)			7.6
2	2013	2015	Bong, Margibi, Nimba, Bomi, G.Bassa, G.Cape Mount			26.2
3	2016	2018	Gbarpoku, G. Gedeh, Lofa, Maryland, River Gee	Bomi, Bong, G.Cape Mount, Montserrado		49.5
4	2019	2021	Grand Kru, Rivercess, Sinoe	Gbarpoku, G.Bassa, G.Gedeh, G.Kru, Lofa, Nimba	Bomi, Bong, Gbarpoku, G.Bassa, G.Cape Mount	77.2
5	2022	2024		Lofa, Maryland, River Gee, Rivercess, Sinoe	Nimba, G.Gedeh, G.Kru, Lofa, Margibi, Maryland, River Gee	73.3
6	2025	2027			Rivercess, Sino	10.5
Sum total						244.3

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 58. Construction Phases—Capital Estimates Are from the Table of Cash Flow Summaries by Business Unit

2. PROGRAM MODEL ASSUMPTIONS

To explore the viability of this program, a financial model with cost and revenue estimates was built-up. The model considered and was based on: (i) the scope defined above, (ii) the demand from Appendix 2: Background, (iii) the reference designs from this appendix, (iv) the above program schedule, (v) the pricing, and (vi) the general assumptions. The model considered three business units: (i) the international network operated by the Cable Consortium of Liberia (CCL); (ii) a national backbone network to the county capitals; and (iii) a rural access network. The model represents an incremental investment to capture an expanded public internet and IP network market. Therefore the revenues are also incremental and related to these markets. Revenues and investments for other markets are excluded -- specifically excluded are existing voice services as well as any resale of ACE (or other network) capacity for other markets, including non-Liberian. Presumably business cases would be developed for any additional opportunities and their inclusion would improve the overall financial performance of the program.

In addition to financial viability, the model was used to roughly assess the project from the perspective of the national economy. This “economic model” version was developed from the financial model by: (i) applying an economic adjustment factor to the revenues, and (ii) removing taxes from the calculation. From this, the economic internal rate of return was calculated.

An upfront one-time charge is levied for fixed subscribers, but not mobile subscribers. A capital cost per fixed subscriber is assumed (per Table 8); whereas mobile subscribers are assumed to pay for their user terminals and the model does not consider any costs (or revenues) from the sale of mobile terminals.

Given that government policy prioritizes ICT development, incentives are likely, or at least, there should be no dis-incentives. Considering this priority, the following cost items are NOT specifically included in the program model: (i) license fees including for offering services, operating networks, or spectrum; (ii) customs and import duty; (iii) building permits; (iv) value added or general sales tax; nor (v) unofficial taxes or illegal payments and bribes. Further, land acquisition and right of way acquisition costs have been assumed minimal. If applicable, these cost items add to the initial capital cost and can be factored in by applying a multiplier to the capital cost estimates.

Year	Schools	Gov't except schools	Med. busin.	Small busin.	Res. broad- band	Mobile internet	Upfront charge per fixed Subscr	CBN rate per 100 Mbps	CCL rate per Mbps
2010	70	35	90	35	25	1	35	1250	700
2011	70	35	90	35	25	1	35	1225	700
2012	70	35	90	35	25	2	35	1200	700
2013	70	35	90	35	25	4	35	1175	700
2014	70	35	90	35	25	4.5	35	1150	600
2015	70	35	90	35	25	5	35	1125	600
2016	70	35	90	35	25	5.5	35	1100	500
2017	70	35	90	35	25	6	35	1075	500
2018	70	35	90	35	25	6.5	35	1050	400
2019	70	35	90	35	25	7	35	1025	300
2020	70	35	90	35	25	7.5	35	1000	250
2021	70	35	90	35	25	8	35	975	200
2022	70	35	90	35	25	8.5	35	950	150
2023	70	35	90	35	25	9	35	925	125
2024	70	35	90	35	25	9.5	35	900	100
2025	70	35	90	35	25	10	35	875	90
2026	70	35	90	35	25	10.5	35	850	80
2027	70	35	90	35	25	11	35	825	70
2028	70	35	90	35	25	11.5	35	800	60
2029	70	35	90	35	25	12	35	775	50
2030	70	35	90	35	25	12	35	750	50

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 59. Pricing Assumptions Applied to the Financial Model; per Month in USD

#	Parameter (units)	Note	Value
1	Tax rate as % of revenue	N01	2.50%
2	Economic multiplier factor	N02	1.5
3	Opex % of revenue, rural access net	N03	1.00%
4	Opex % of revenue, fiber optic net	N03	1.00%
5	Opex component as % of revenue, CCL	N03	1.00%
6	Rural access network project overhead	N04	25%
7	Rural access net capex contingency	N05	15%
8	Rural access net average asset life (years)	N06	10
9	County capital network project overhead	N04	20%
10	County capital network capex contingency	N05	15%
11	County capital net average asset life (years)	N06	15
10	Cost per kWh for electric power (USD)		0.5
11	Discount rate, for NPV calculations		14.0%

N01 Corporate tax is only applied in cash flow positive years.
N02 This factor is applied to the revenue as a proxy for the economic benefit of the service.
N03 Some costs, such as customer administration and marketing are a function of sales. These costs are in addition to other facility operations and maintenance costs.
N04 Project overhead covers planning, spares, test equipment training, project management, shipping and integration allowances.
N05 Contingency includes physical (omissions and deviation in conditions) and pricing (escalations, lack of volume breaks, etc.)
N06 Asset life is only used to estimate residual value at end of study period.

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 60. Financial Model General Assumptions

3. FINANCIAL AND ECONOMIC VIABILITY

Cash flow summaries for each business unit and the combined project are presented in the first figure below. The baseline results of the model are summarized in second figure below.

Year	Combined Results					Cable Consortium of Liberia (CCL)				
	Capex	Opex	Tax	Revenue	Total	Capex	Opex	Tax	Revenue	Total
2010	11.10	0.00	0.00	0.00	-11.10	11.10	0.00	0.00	0.00	-11.10
2011	15.97	0.00	0.00	0.00	-15.97	15.21	0.00	0.00	0.00	-15.21
2012	9.95	0.18	0.00	0.04	-10.09	3.15	0.18	0.00	0.04	-3.29
2013	7.76	4.66	0.00	0.97	-11.45	0.00	1.78	0.00	0.65	-1.13
2014	5.26	7.20	0.00	1.97	-10.48	0.00	1.80	0.00	1.23	-0.56
2015	13.18	7.33	0.11	5.73	-14.89	0.00	1.83	0.11	4.29	2.35
2016	2.90	7.88	0.29	13.64	2.57	0.00	1.90	0.29	11.67	9.47
2017	12.88	11.76	0.70	30.40	5.06	0.00	2.07	0.70	28.12	25.35
2018	38.73	16.56	0.96	41.93	-14.32	5.00	2.47	0.96	38.55	30.12
2019	47.33	23.89	1.10	50.16	-22.16	0.00	2.53	1.10	44.07	40.44
2020	22.59	39.77	1.31	72.94	9.28	5.00	2.91	1.31	52.25	43.04
2021	22.32	49.54	1.37	92.42	19.18	10.00	3.50	1.37	54.79	39.92
2022	45.19	61.58	2.06	106.83	-2.01	5.00	3.76	1.28	51.27	41.22
2023	18.14	79.85	2.47	138.47	38.01	5.00	4.10	1.36	54.49	44.03
2024	24.99	83.82	2.43	147.41	36.16	5.00	4.33	1.20	48.20	37.66
2025	13.43	92.06	2.59	167.45	59.37	5.00	4.63	1.20	48.17	37.33
2026	1.32	94.30	4.47	178.98	78.88	0.00	4.61	1.14	45.73	39.98
2027	5.72	93.25	4.58	183.24	79.69	5.00	4.87	1.04	41.42	30.52
2028	0.35	90.35	4.61	184.33	89.02	0.00	4.81	0.91	36.24	30.52
2029	0.11	85.88	4.55	182.05	91.50	0.00	4.76	0.76	30.46	24.95
2030	-39.50	84.40	4.52	180.81	131.39	0.00	4.76	0.76	30.59	25.07

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Year	County backbone network (CBN)					Rural access network (RAN)				
	Capex	Opex	Tax	Revenue	Total	Capex	Opex	Tax	Revenue	Total
2010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2011	0.76	0.00	0.00	0.00	-0.76	0.00	0.00	0.00	0.00	0.00
2012	6.80	0.00	0.00	0.00	-6.80	0.00	0.00	0.00	0.00	0.00
2013	7.76	2.88	0.00	0.32	-10.32	0.00	0.00	0.00	0.00	0.00
2014	5.26	5.40	0.00	0.74	-9.92	0.00	0.00	0.00	0.00	0.00
2015	13.18	5.50	0.00	1.43	-17.24	0.00	0.00	0.00	0.00	0.00
2016	2.90	5.98	0.00	1.98	-6.90	0.00	0.00	0.00	0.00	0.00
2017	11.91	9.65	0.00	2.28	-19.27	0.97	0.04	0.00	0.00	-1.02
2018	26.02	12.94	0.00	3.07	-35.89	7.71	1.15	0.00	0.31	-8.55
2019	16.34	17.09	0.00	4.45	-28.97	31.00	4.27	0.00	1.64	-33.63
2020	0.53	23.61	0.00	12.72	-11.42	17.06	13.25	0.00	7.98	-22.33
2021	0.59	24.06	0.00	21.71	-2.95	11.73	21.98	0.00	15.92	-17.79
2022	0.63	24.96	0.78	31.29	4.92	39.56	32.86	0.00	24.26	-48.15
2023	1.04	30.24	1.11	44.32	11.93	12.10	45.51	0.00	39.66	-17.95
2024	0.58	28.38	1.23	49.16	18.97	19.41	51.10	0.00	50.05	-20.47
2025	0.66	30.04	1.38	55.32	23.23	7.77	57.38	0.00	63.97	-1.19
2026	0.46	29.56	1.45	58.14	26.66	0.86	60.13	1.88	75.11	12.24
2027	0.26	27.38	1.47	58.94	29.82	0.46	61.01	2.07	82.88	19.34
2028	0.16	24.47	1.47	58.87	32.77	0.19	61.07	2.23	89.21	25.72
2029	0.05	21.01	1.44	57.72	35.21	0.06	60.11	2.35	93.86	31.35
2030	-14.10	21.07	1.40	55.99	47.61	-25.40	58.56	2.36	94.23	58.70

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 61. Cash Flow Summaries, by Business Unit and Combined (in USD Millions)

Indicator	Total	CCL	CBN	RAN
Financial net present value (NPV)	8.3	74.5	-38.4	-27.8
Financial internal rate of return (FIRR)	15.1%	30.3%	4.3%	-2.0%
Economic net present value	152.3			
Economic internal rate of return (EIRR)	27.9%			
NPV is based on a discount rate of 14%.				

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 62. Results of Financial and Economic Model Analysis. CCL=Cable Consortium of Liberia; CBN=County Backbone Network; RAN=Rural Access Network

The overall program financial internal rate of return 15%. Consequently, with a discount rate of 14%, the overall financial net present value (NPV) is slightly positive. These preliminary findings indicate that the county backbone and rural access networks require subsidy for viability. Fortunately both of these components eventually turn cash positive. Therefore a one-time capital cost contribution subsidy should be an effective incentive. Using NPV for the county backbone and rural access networks as an indicator, in rough order of magnitude terms, each of these network initiatives can be expected to need a subsidy of about \$50 million.

It is noted that overall the program is good for the economy, with an economic internal rate of return conservatively estimated to be in the 25-30% range.

In evaluating these findings, the inter-relationship between the business units should be noted. Specifically, the results are shown for three business units: Cable Consortium of Liberia (CCL), county capital backbone network (CBN), and rural access network (RAN). There are cash flows between these businesses. The rural access network pays the county backbone network for transit (which is an operating expense for the rural access network and revenue for the county backbone network). The county backbone network pays the Cable Consortium of Liberia for international traffic transit (which is an operating expense for the county backbone network and revenue for the Cable Consortium of Liberia). Although the rural access network and the county backbone network have low internal rates of return, the overall set of projects within the sector are viable.

Note that the standalone viability of the rural access network can be improved by lowering the price for national transit on the county backbone network; however this reduces the viability of the county backbone network. The standalone viability of the county backbone network can be improved by lowering the price of international traffic transit (and/or raising the price charged to the rural area network—however this reduces the viability of the rural area network). The model assumes that prices for network transit services are uniformly applied. This means that operators in Monrovia pay the same price for international transit as the county backbone network. The operators in the county capitals pay the same price for national transit as the rural access network operators. Therefore any CCL and county backbone network price reductions affects more than just the transfer payments between these businesses—they would also reduce overall program viability.

4. SENSITIVITY AND RISK ANALYSIS

A sensitivity analysis was conducted (i) to look for sensitivities to specific variables that may indicate high risk, and (ii) to explore the resilience of the findings across a range of possible input assumption variations. The results are believed to be relatively robust across a range of scenarios. Figure 63.

Sensitivity Analysis for Broadband Connectivity Program Assumption Variations provides the results for the different scenarios tested. From the table, the following observations are made:

1. As expected, a 10% change in most assumptions has only a minor impact on viability measured as internal rate of return (IRR) -- typically less than 0.1%.
2. There is reasonable sensitivity to capital expenditures. A 10% change in capital expenditures for any of the business units changes the overall IRR by about 0.5%.
3. There is more sensitivity to mobile internet and residential broadband traffic because the demand model forecasts mobile internet and residential broadband to dominate over business and government traffic in the long term.
4. There is also some sensitivity to the expected incremental revenue from the mobile internet subscribers because the mobile internet subscribers are expected to dominate in terms of numbers (this will be the most affordable internet access technology and service).
5. The results from scenario 7 to 20 are of some interest. This shows that as the traffic increases, the rural access network IRR decreases; and vice versa, as traffic increases, the rural access network IRR decreases. The IRR decrease for the rural access network is because the rural access network business unit pays more to the county backbone network as traffic increases. And, as expected, the county backbone network IRR increases with this additional revenue (and the overall IRR increases slightly).
6. Looking at scenario 23 to 27 shows a related effect. Decreasing the price for the county backbone improves the rural access network IRR at the expense of the county backbone network (and vice versa). Decreasing the price reduces the overall IRR because there are other traffic streams from the county capitals that are not carried on the rural access networks (i.e., there is other traffic, so the effect does not cancel-out).

#	Scenario	FIRR % Change *	Program FIRR	Program EIRR	FIRR		
					CCL	CBN	RAN
0	Baseline	---	15.1%	27.9%	30.3%	4.3%	-2.0%
1	Capital investment for ACE escalates 10%	-0.49%	14.6%	27.2%	28.8%	4.3%	-2.0%
2	Capital investment for ACE decreases 10%	0.52%	15.6%	28.7%	31.9%	4.3%	-2.0%
3	Capital investment for county backbone network (CBN) escalates 10%	-0.55%	14.5%	27.3%	30.3%	3.7%	-2.0%
4	Capital investment for county backbone network (CBN) decreases 10%	0.58%	15.7%	28.5%	30.3%	4.9%	-2.0%
5	Capital investment for rural access networks (CBN) escalate 10%	-0.43%	14.7%	27.6%	30.3%	4.3%	-2.8%
6	Capital investment for rural access networks (CBN) decrease 10%	0.43%	15.5%	28.2%	30.3%	4.3%	-1.0%
7	Mobile internet traffic per user 10% increase	0.33%	15.4%	28.5%	30.9%	5.3%	-5.5%
8	Mobile internet traffic per user 10% decrease	-0.36%	14.7%	27.3%	29.6%	3.1%	1.4%
9	Mobile internet customers 10% increase	1.14%	16.2%	29.0%	30.9%	5.3%	-0.6%
10	Mobile internet customers 10% decrease	-1.24%	13.8%	26.7%	29.6%	3.1%	-3.5%
11	Residential broadband traffic per user 10% increase	0.48%	15.6%	28.5%	31.0%	3.9%	-2.0%
12	Residential broadband traffic per user 10% decrease	-0.48%	14.6%	27.3%	29.5%	4.6%	-2.0%
13	Residential broadband customers 10% increase	0.58%	15.7%	28.7%	31.2%	3.9%	-1.9%
14	Residential broadband customers 10% decrease	-0.48%	14.6%	27.3%	29.5%	4.6%	-2.0%
15	Business traffic per user 10% increase	0.01%	15.1%	28.0%	30.3%	4.3%	-2.1%
16	Business traffic per user 10% decrease	-0.03%	15.1%	27.9%	30.2%	4.3%	-1.9%
17	Business customers 10% increase	0.01%	15.1%	27.9%	30.3%	4.3%	-2.0%
18	Business customers 10% decrease	-0.02%	15.1%	27.9%	30.3%	4.3%	-2.0%
19	Government traffic per user 10% increase	0.03%	15.1%	28.0%	30.3%	4.5%	-2.3%
20	Government traffic per user 10% decrease	-0.02%	15.1%	27.9%	30.2%	4.1%	-1.7%
21	Price charged for international capacity increase 10%	1.06%	16.1%	29.2%	31.9%	2.9%	-2.0%
22	Price charged for international capacity decrease 10%	-1.06%	14.0%	26.6%	28.4%	5.5%	-2.0%
23	Price charged for national backbone capacity increase 10%	0.09%	15.2%	28.2%	30.3%	6.4%	-5.8%
24	Price charged for national backbone capacity decrease 10%	-0.12%	15.0%	27.7%	30.3%	1.8%	1.6%
25	Price charged for mobile internet usage increase 10%	0.34%	15.4%	28.1%	30.3%	4.3%	0.0%
26	Price charged for mobile internet usage decrease 10%	-0.49%	14.6%	27.7%	30.3%	4.3%	-5.3%
27	Price charged for residential broadband increase 10%	0.01%	15.1%	27.9%	30.3%	4.3%	-1.9%
28	Price charged for residential broadband decrease 10%	-0.01%	15.1%	27.9%	30.3%	4.3%	-2.0%
29	Price charged to business increase 10%	0.02%	15.1%	27.9%	30.3%	4.3%	-1.9%
30	Price charged to business decrease 10%	-0.02%	15.1%	27.9%	30.3%	4.3%	-2.0%
31	Price charged to government increase 10%	0.04%	15.1%	27.9%	30.3%	4.3%	-1.8%
32	Price charged to government decrease 10%	-0.04%	15.1%	27.9%	30.3%	4.3%	-2.2%
33	Annual maintenance for ACE increases to 10% from 6%	-1.05%	14.0%	27.1%	28.7%	4.3%	-2.0%
34	Annual maintenance for ACE decreases to 3% from 6%	0.79%	15.9%	28.5%	31.4%	4.3%	-2.0%
35	Annual maintenance for O3b increases to 10% from 5%	-0.04%	15.0%	27.9%	30.3%	4.2%	-2.0%
36	Annual maintenance for O3b decreases to 3% from 5%	0.02%	15.1%	27.9%	30.3%	4.3%	-2.0%
37	Annual space segment cost for O3b increases by 10%	-0.20%	14.9%	27.7%	30.3%	4.0%	-2.0%
38	Annual space segment cost for O3b decreases by 10%	0.20%	15.3%	28.1%	30.3%	4.5%	-2.0%
39	Annual maintenance for fiber backbone increases by 10%	-0.06%	15.0%	27.9%	30.3%	4.2%	-2.0%
40	Annual maintenance for fiber backbone decreases by 10%	0.07%	15.2%	28.0%	30.3%	4.4%	-2.0%
41	Annual maintenance for rural access networks increase by 10%	-0.09%	15.0%	27.9%	30.3%	4.3%	-2.4%
42	Annual maintenance for rural access networks decrease by 10%	0.11%	15.2%	28.0%	30.3%	4.3%	-1.5%
43	Average cost of power increases 30% (from \$0.5/kWh to \$0.65)	-0.18%	14.9%	27.8%	30.3%	4.2%	-2.4%
44	Average cost of power decreases 50% (from \$0.5/kWh to \$0.25)	0.30%	15.4%	28.1%	30.3%	4.5%	-1.2%
45	Corporate tax rate as % of gross revenue increases from 2.5% to 3.5%	-0.29%	14.8%	27.9%	30.1%	4.1%	-2.4%
46	Corporate tax rate as % of gross revenue decreases from 2.5% to 1.5%	0.28%	15.4%	27.9%	30.4%	4.5%	-1.6%
47	Average asset life for county backbone increases from 15 to 20 years	0.16%	15.2%	28.0%	30.3%	4.9%	-2.0%
48	Average asset life for county backbone decreases from 15 to 10 years	-0.11%	15.0%	27.9%	30.3%	3.8%	-2.0%
49	Average asset life for rural access networks increase from 10 to 15 years	0.32%	15.4%	28.0%	30.3%	4.3%	1.0%
50	Average asset life for rural access networks decrease from 10 to 5 years	-0.22%	14.9%	27.9%	30.3%	4.3%	-4.5%

* % change from baseline FIRR.

[From: GVIC-0301 Liberia Broadband Program Model.ods - Rev3]

Figure 63. Sensitivity Analysis for Broadband Connectivity Program Assumption Variations

APPENDIX 5: REGULATORY REQUIREMENTS

1. REQUIREMENT FOR SUPPORTIVE REGULATORY FRAMEWORK IN LIBERIA

1.1 The Universal Access Fund

In terms of the 2007 Act, LTA may recommend and the Minister may approve a policy for the promotion of universal access. This is defined in the Act as “ensuring the provision of telecommunications services and telecommunications facilities to residents and other members of the general public in Liberia, in accordance with a universal access policy developed and approved pursuant to section 22”. GoL recently adopted the ICT Policy which states that a Universal Access Fund (UAF) shall be established and that licensed telecommunications and ICT service providers shall contribute between 0.5% and 2.0% of their revenues annually to the Fund (in the range of \$250,000 to \$1.0 million).

More detailed regulations will be required to enable administration of the Fund and clarify the basis on which subsidies may be made available. Section 23 of the Act anticipates that the Minister may approve a regulation “to establish a Universal Access Fund to subsidize in whole or part, the net costs of providing universal access”. Operation of the Fund is to be subject to specific reporting, accounting and auditing requirements established by the Ministry of Finance, and to include budget approval process to the Legislature established by other laws.

This Fund should be the primary source of funds for the subsidization of universal access projects such as those anticipated in the Action Plan. Until such time as LTA has consulted on an appropriate regulation to establish the Fund and determine the way in which it will operate, contributions to the Fund cannot be made. We recommend that LTA consult as soon as possible with relevant Ministries and members of industry to determine:

1. the most appropriate way to create the Fund
2. how it should invest contributions received
3. how these might be allocated amongst priority projects
4. on what basis projects will be identified
5. what the tender process will consist in for each project
6. how awards will be made and in what amount
7. how awards and projects will be monitored and compliance with the terms of the award enforced.

As with all regulatory processes, it will be vital to establish a long and short term plan and budgetary requirements, and to make known in as transparent a way as possible, how funds will be dealt with so as to avoid any adverse implications regarding what are essentially public funds. As required by the 2007 Act, the Ministry of Finance should be consulted on budgeting and reporting requirements. The administration of the Fund by a suitably qualified team will be a similarly important consideration.

1.2 The Regulatory Regime for Access to Capacity on ACE

Simply introducing high speed internet capacity to Liberia via the landing point and then distributing it to Liberians is not sufficient to ensure that Liberians obtain low cost internet access. For example, Kenyans only obtained truly low cost internet access after a fourth cable, EASSy, was about to commence service in early 2010 – prior to then, private operators maintained relatively high prices for internet access.

Given that there will be limited or no effective competition to ACE in the provision of low cost high capacity internet in Liberia for many years, a strong regulatory regime is needed. This regime will need to include the terms on which the ACE cable landing point is licensed, and more than likely will require that LTA control prices at both the wholesale level (for example service to other operators, banks and large NGOs) and retail level (service to individual or SME-type subscribers). In effect, the prices at which operators will be permitted to offer internet access should be limited (for example by way of price ceilings) in order for as many Liberians as possible to obtain affordable internet access at reasonable prices. This will require a balancing act so that operators are nonetheless encouraged to build new infrastructure to distribute access to new geographic and demographic markets.

In essence, maintaining low or cost-oriented prices will encourage operators to reach out with infrastructure to obtain access to new customers and markets within Liberia. If operators are permitted to sell internet access at high prices they will have little incentive to invest in new infrastructure to reach new subscribers – profits from existing customers would continue to be substantial, but similarly price controls must be reasonable and oriented towards costs without hampering the operators' ability to use profit margins for expansion. We believe it will be important for LTA to issue guidelines sooner rather than later, indicating what steps it may take to create a suitable regulatory framework for the cable and related capacity sales. These guidelines would then be followed by clear regulations.

In order to provide international connectivity and broadband services in Liberia at reasonable prices, there are no other alternatives at present, which situation means that CCL will be a monopoly. Therefore, access to the cable on reasonable terms must be facilitated by LTA and the cost of both retail and wholesale capacity must also be controlled by LTA. This can be done in one of two ways:

1. By imposing conditions within the CCL licence that require that access be given to requesting parties on reasonable and non-discriminatory terms;
2. By introducing price regulation which will require some analysis of cost information regarding the landing point, CCL's own (additional) costs, and cost of service to consumers.

This regulation need not unnecessarily constrain the ability of the landing point to obtain financing directly, as the landing point would exhibit aspects of a stable regulated utility with regulated tariffs, which would not be unattractive to lenders. Liberian operators would still have an incentive to manage the landing point as inexpensively and efficiently as possible in order to maximize their returns in the context of fixed tariffs. Under firm LTA regulation, instead of operators simply selling access for as high a price as can be obtained, CCL and operators would be incentivized to maximize uptake or capacity sold by building local Liberian infrastructure to support broad expansion of the customer base and usage by wider sections of the internet consumer pyramid.

In other words, LTA must establish a regulatory framework that eliminates any short-term incentive for operators to charge high prices for international connectivity and simultaneously encourages the operators to obtain their profits from the landing point by constructing and operating local infrastructure in Liberia that can be used to distribute low-cost internet access across the country. LTA's role must therefore include correcting any market pricing failure that occurs in the landing of capacity to Liberia and the on-selling of that capacity (whether wholesale or retail).⁴⁸

2. WORLD BANK TECHNICAL ASSISTANCE TO LTA

The World Bank intends to provide funding for technical assistance to LTA to develop the regulatory framework to support ACE and distribute affordable connectivity across Liberia. Using the World Bank funding, LTA will engage a consulting firm to advise on development of the regulatory framework which can be expected to include the following components:

⁴⁸ Section 1.5.4 of the Rapid Assessment Report.

- A license for CCL to operate, maintain and distribute the capacity of the ACE landing point
- Wholesale and/or retail price controls on the sale of capacity by CCL and also similar price controls on operators which distribute ACE capacity that they purchase from CCL;
- Upgrade of licenses of operators to “universal”⁴⁹ licenses or 3G licenses in order to enable them to roll out the wireless, 3G and NGN infrastructure needed to distribute ACE capacity; and
- Establishment of a Universal Access Fund as envisaged by the 2007 Act and the National Telecom and ICT Policy 2010 in order to subsidize investment by operators in the infrastructure needed to distribute ACE.

3. FAST TRACK ACTION PLAN

The steps outlined in the section above, will with World Bank Technical Assistance, comprise the Action Plan for developing the regulatory regime to support ACE and CCL. The full Action Plan in Appendix 1 includes timelines and further detail regarding this plan. LTA will need to put the regime in place prior to the commercial launch of service and ideally some certainty will be given to operators and investors some time before the end of 2012. LTA should also, in the first phase, take all such necessary steps to establish the UAF and to determine priority projects to which subsidies may be made available.

4. NEED FOR LTA INVOLVEMENT

LTA’s role in creating a suitable regime for universal access and specifically for access to the landing point and to capacity from it is critical. LTA is endowed with powers to advise the Minister on policy, issue licences, implement tariff regulation, monitor and enforce compliance with licence terms, regulate interconnection, resolve disputes, and institute and maintain appropriate measures for the purpose of preventing service providers from engaging in or continuing anti-competitive practices, including the identification of telecommunications markets (such as broadband), determining dominance and abuse of dominance in identified telecommunications markets, and responding to anti-competitive agreements.

LTA is required, under section 11 of the 2007 Act, to “act independently in performing the responsibilities, functions and powers set out in this Act and other applicable laws, and in this regard... LTA shall act in a manner that is separate from and not accountable to, any service provider, including a service provider owned by the Government of Liberia, and the orders and rules made and the procedures used by the LTA shall be impartial with respect to all service providers and market participants....”

As ACE will represent the only source of international connectivity aside from high cost VSAT, competitive pricing cannot be achieved in Liberia without decisive regulatory leadership by LTA. In particular, we believe that the regulatory framework must treat the landing point as a regulated utility at least until a second low-cost, high-capacity source of international connectivity is available in Liberia. LTA must establish a regulatory framework that eliminates any short-term incentive for operators to charge high prices for international connectivity and simultaneously encourages the operators to obtain their profits from the landing point by constructing and operating local infrastructure in Liberia that can be used to distribute low-cost internet access across the country.

Effectively, LTA’s role should include correcting any market pricing failure in landing capacity to Liberia and on-selling that capacity (whether wholesale or retail). We deal with this in more detail below. LTA will also need to create an appropriate licence model for CCL (international gateway or cable landing point licence) within the current framework whilst anticipating a move to a universal licence model, and

⁴⁹ The universal licence is a model of licence which permits licensees to provide any form of service using any form of technology – it is the licence which facilitated technological convergence. This form of licence has been granted in other countries in Africa including Nigeria and South Africa, and many countries are moving their regulatory regimes towards this licence model in order to accelerate the development of their markets.

enforce existing interconnection and facilities-leasing regulations to ensure that existing infrastructure is used efficiently. ACE cable landing point as an “essential facility”

As mentioned earlier in this report, in many African countries and particularly Liberia, the likelihood of landing another cable is almost non-existent. In order to provide international connectivity and broadband services in Liberia at reasonable prices, there are no other alternatives at present. Therefore in order to “compete”, access to the cable must be facilitated.

The doctrine of granting access to “essential facilities”⁵⁰ is often used in relation to subsea cables as although alternative methods of obtaining international connectivity and high capacity broadband services exist (by satellite or other terrestrial options), the costs of duplicating the cable landing point are simply too high to render construction of a second or third cable landing most unlikely. This set of facts results in a monopoly situation.

International papers on the regulation of undersea cables (based on ITU doctrines) suggest that the approaches that can be taken to control the monopolies associated with undersea cables are:

- the enactment of a statute (or in this case, amendment of the existing Liberian Telecommunications Act);
- the application of competition law (or the competition provisions applying under the Liberian Telecommunications Act); and
- Implementation of appropriate telecommunications regulations.

Remedies are not mutually exclusive but can be combined in ways appropriate to the circumstances of the country concerned. Any regulation that opens access to submarine cables at the landing station is highly likely to need to be coupled with measures to ensure the provision of backhaul capacity. It will be necessary for competing operators and service providers to be able to construct or to lease from third parties the links from their place of business to the cable landing station. This may require the regulation of:

- domestic leased lines;
- the provision of spectrum for microwave point-to-point links;

⁵⁰ According to the ICT Regulation Toolkit, section 2.4.4 (Essential Facilities) essential facilities are resources or facilities that have the following properties:

- They are critical inputs to retail production. Essential facilities are located at the wholesale level of the production chain, and are essential inputs in the production or supply of the retail product or service,
- They are fully owned and controlled by vertically integrated incumbent firms. The owner of the facility participates in the retail as well as the wholesale stage of the market,
- They are a monopoly. Retail competitors can only acquire an essential facility from the incumbent firm that owns and controls it,
- It is not feasible, either economically or technologically, for retail competitors to duplicate the essential facility or develop a substitute for it.

At the wholesale level the incumbent supplies other firms with a critical input, and those firms are dependent on the incumbent for that input. At the retail level, the incumbent competes with those same firms (see Figure 1). The owner of an essential facility may seek to use its position to prevent or impede competition, by implementing a “price squeeze” or even refusing to supply the facility.

- the right to dig trenches for cables; and
- access to roof space for antennae⁵¹.

It may also be necessary to ensure that operators can purchase a leased line supplied by the incumbent operator or in Liberia's case a rival, from the landing station and then interconnect to their own networks.⁵²

5. LICENSING OF CCL AND OPERATORS TO DISTRIBUTE CAPACITY ON ACE

In order to assist LTA in deciding on an appropriate license for the Landing Station and to determine the appropriate level at which it might set the related license fee, this document provides selected examples of licensing of international gateways and cable landing points. This survey includes a table of licensing fees and provisions in other countries and selected case studies for licensing of landing points (Mozambique, Kenya, Nigeria, United States and South Africa).

We also provide preliminary high level options regarding licensing of the Liberia ACE Cable Landing Point, based on Liberian operators' vision for CCL as a pass-through entity in which other investors may participate. We understand this to mean that CCL will pass through capacity directly to operator-shareholders who themselves lease capacity to other operators, as well as distribute capacity on a retail basis to business and residential customers; revenue received from these activities will fund ongoing operations and maintenance of the Landing Point. The report remains valid even if the investment model changes.

By way of introduction, it should be noted that although cable landing stations form part of the group of facilities designated as "international gateway facilities", they are not the only such facilities. Other international gateways include VSAT, other satellite ground segments, and terrestrial microwave gateways. However, cable landing stations are generally considered to be "bottleneck" facilities in that it is difficult to replicate them without significant investment and obviously, access to passing subsea cables.

Cable landing stations should, in the context of the introductory paragraphs in this section, be regarded as the subsea cable itself within Liberian territorial waters, the part of the cable that is landed at the beach joint, and the landing station structure itself, which is where backhaul and interconnection with other networks will take place.

In this report we have used the terms "international gateway" and "cable landing station" interchangeably to some extent, as it is useful to consider how international gateways in general are regulated and what fees are charged, and then to compare (as we have done) the licensing of and charges applied to, cable landing stations. This is because, as the report indicates below, the ownership and operation of a cable landing station as a "bottleneck" or "essential" facility requires a more considered licensing framework and in general, the operation of it and provision of services across it is subject to more restrictive licence

⁵¹ In Singapore the Infocomm Development Authority (IDA), the national regulatory authority, directed SingTel to modify its Reference Interconnection Offer (RIO) to include the provision of access to its cable landing station under specified terms and prices. SingTel had been designated as being a dominant operator. In 2004, the Telecom Regulatory Authority of India (TRAI) began the process of regulating the price of International Private Leased Circuits (IPLCs). It was able to calculate a cost-based tariff for an E1 (2 Mbits/second) at INR 1,200,000 (or €21,600) per annum and used the ratios of 1:8:23 for E1, DS3 and STM1 lines. The effect was a price reduction of about 40% in the case of E1 and about 70% in the case of DS3 and STM1. This was based on the use of both a cost-based accounting approach and an annual recurring cost model, which both gave similar figures. The TRAI also made extensive comparisons with other countries.

⁵² "The regulation of undersea cables and landing stations", Stephen Esselaar, Allison Gillwald and Ewan Sutherland, WITS Link Centre with IDRC, 2007.

conditions to ensure that third party licensees can nonetheless benefit from capacity and services across the cable even though the landing station can only be operated by and therefore licensed to, one entity.

6. AFFORDABLE ACCESS NOT ACHIEVABLE WITHOUT REGULATION

Under the CCL agreement, Liberian operators are both wholesale providers and retail distributors of the internet access provided by CCL shareholders, creating an inherent conflict in their role as price-setters to subscribers.

Theoretically, including GoL in CCL might dampen the impact of the conflict of interest between the role of operators as providers and customers of the landing point and therefore be more likely to result in lower prices for internet access in Liberia. GoL has an inherent incentive to maximize overall benefits to Liberian residents from ACE (or other international connectivity option) by promoting ICT literacy, e-Government, e-Education, e-Banking and other uses. However, the fact that LTA will continue to operate completely independently of the consortium in regulating the landing point more than offsets any potential pricing pressure which may result through inclusion of GoL as a member of the consortium.

In addition to the current high prices for internet access in Liberia, as the Liberia Connect Report notes, “Across the entire [Liberian telecom] sector, these kinds of prices drive providers to oversell their capacity, which results in extreme congestion and poor service to all users.”⁵³ In order for Liberia to fully benefit from ACE, therefore, it is insufficient to simply benchmark the price for access in Liberia using ACE against existing pricing for Liberian internet access which relies on VSAT.

It is very possible that ACE will reduce connectivity prices from the current high prices. However, ACE pricing will not meaningfully impact Liberian ICT competitiveness in a global context. If this price includes transit, then the cost associated with international connectivity is presumably even less than \$10 per Mb in these larger, more competitive developed markets.

7. SAT-3 AND EASSY EXPERIENCE EMPHASIZES NEED FOR STRONG REGULATION

The experience with SAT-3 and speculation regarding the likely impact of EASSy supports the need for robust regulation.

The SAT-3 cable experience suggests that substantial price reductions for service to Liberians are unlikely to be achieved in the near term after ACE launch without firm regulation by LTA. Although wholesale prices for international connectivity declined after launch of SAT-3 service, that cable failed to substantially reduce retail prices for internet connectivity in most countries in Africa, even in larger advanced countries such as South Africa.⁵⁴ Initial results with SAT-3 showed that the limited elasticity of consumer demand allowed SAT-3 operators to initially maintain pricing only slightly below pricing using satellite. The Consultants understand that SAT-3 initially established high prices in the range of \$10-15,000 per Mbps per month (even though cost of providing the service was in the range of \$2,000 per month), which limited the potential for users in many countries to take advantage of SAT-3.

In fact, even after two other international fiber optic cables, the East African Marine System (TEAMS) and Seacom launched service in East Africa in mid 2009, the cost of internet access still failed to decline as substantially as had been hoped.

This oligopolistic pricing concern will be particularly important in a small market such as Liberia where the increasing concentration of market share by Lonestar and Cellcom leaves the smaller mobile operators

⁵³ Trip Report: Liberia Connects, by Jonathan Metzger, Vice President, AED and Dr. Dennis Foote, Retired Vice President, AED, December 12-16, 2009

⁵⁴ Although this was in part because of monopoly participation in the cable by the South African incumbent, then state-owned.

and ISPs in an increasingly untenable financial situation.⁵⁵ In addition, one ISP reported that the number of independent Internet Service Providers⁵⁶ in Liberia had recently declined from seven to ten.⁵⁷

With the expected arrival of EASSy in 2011, there is renewed hope for substantial reductions in prices towards global benchmarks, though operators and other stakeholders dispute this expectation. Telecom operators interviewed recently in Kenya stated that “no price reduction would be effected soon” after EASSy completion.⁵⁸

8. REGULATORY RECOMMENDATIONS

The following steps need to be considered for implementation by GoL and LTA in order to ensure operator concerns are addressed, Libtelco’s role is clarified and limited, GoL’s policy goals are aligned with the sector’s and vice versa, and LTA has the powers and authority that it needs to carry out the changes and implement the policy that the cable landing will require:

- *A universal access regulation.* The 2007 Act provides that LTA may prescribe and the Minister may approve a regulation which establishes the Universal Access Fund to be used to subsidize, in whole or part, the net costs of providing universal access⁵⁹. LTA will be required under the 2007 Act and under the ICT Policy, to develop regulations in terms of which it requires contributions from operators to the Fund, determine priorities for the Fund to focus on (such as the distribution of broadband infrastructure to rural county capitals and between them), invite bids for identified projects, and assess the terms on which subsidies may be made available in relation to these projects. Monitoring the application of the subsidies will of course also be critical to ensure they are correctly and efficiently applied.
- *Licensing of Cable Landing Point.* CCL will itself require a licence in order to ensure that it is authorized to do all such things and to operate all such technologies as may be required. It will need authority in the form of a license issued by LTA under the Telecommunications Act, 2007⁶⁰ (the Act) which gives it rights to install, own and operate international facilities and to make services over the cable landing point available to requesting parties including members of CCL itself. This may be an international gateway licence or a cable landing station licence. In future, it will be important to ensure that other all categories of individual network licence (including the licence granted to CCL) are technology-neutral and not unduly restrictive⁶¹.
- *Universal Licenses for Operators.* Flowing from the licensing point above, all operators that distribute ACE internet capacity will require universal licenses (or at the least upgraded 3G and 4G

⁵⁵ Trip Report: Liberia Connects, by Jonathan Metzger, Vice President, AED and Dr. Dennis Foote, Retired Vice President, AED, December 12-16, 2009

⁵⁶ Operators not operated by mobile operators.

⁵⁷ Trip Report: Liberia Connects, by Jonathan Metzger, Vice President, AED and Dr. Dennis Foote, Retired Vice President, AED, December 12-16, 2009.

⁵⁸ Tuesday, March 9th, 2010 | Posted by ITNewsAfrica.com. “EASSy Unlikely to Affect Cost of Connectivity”.

⁵⁹ Section 23 of the 2007 Act.

⁶⁰ Liberian Telecommunications Act, 2007, Article **15. Requirement to Hold License** (1) No person shall: (a) provide a telecommunications service to the public for direct or indirect compensation; or (b) own or operate a telecommunications network used to provide a telecommunications service to the public for direct or indirect compensation.

⁶¹ Currently mobile operators are required to use 2G and GSM technology in the main (this is prescribed in their licences), and Lonestar does not have authority to resell capacity to corporate users. This is unnecessarily restrictive and runs counter to international trends in terms of which regulatory authorities facilitate convergence by permitting operators to use any technology to provide any service.

licenses) in order to be in a position to deploy the wireless technologies required to connect Liberians to ACE on the most cost effective basis.

- Law. Changes to the Act may be required to recognize that the landing station is an “essential facility” and to endow LTA with powers to regulate the entity with control of that facility through appropriate controlling conditions on CCL’s operation of the landing point and the terms on which capacity is made available.
- Competition framework. It may be useful to begin the review of the Act with a review of the competition framework provided for within the Act to determine the extent to which LTA can use that framework to:
 - Determine a relevant market for international broadband services
 - Determine the cable landing point to be an essential facility
 - Define dominant operators as (i) having significant market power in the relevant market, and/or (ii) control of an essential facility
 - Determine appropriate conditions to be imposed in the licences of dominant operators to control dominance and mandate access
 - Introduce price regulation to limit the prices or maximum prices that may be charged by dominant operators for (i) access to the cable, and (ii) co-location and interconnection, and (iii) downstream services (wholesale and retail).
- Assessing dominance. At the stage when the framework is in place, LTA will need to determine that CCL is dominant by virtue of its control of essential facilities, and the members of CCL who currently are anticipated to have exclusive rights to capacity on the cable, may also be regarded as having significant market power in the market for international broadband capacity. As a result, any agreements concluded by them should not restrict or determine prices at which capacity may be sold which are greater than cost plus a reasonable margin, nor should these prices be predatory (although in the Liberian market this is far less likely). These determinations must be published and consulted on and later incorporated into regulations and/or licence conditions.
- Detailed infrastructure/facilities regulation. It will also be important for LTA to consider how to regulate domestic leased lines, the provision of spectrum for microwave point-to-point links, the right to dig trenches for cables, and access to roof space for antennae, access to ducts and trenches, access to premises at the cable landing point for interconnection and backhaul, and service provision to consumers and intermediary service providers. All operators appear to agree that infrastructure-sharing will save all operators substantial costs.
- Price regulation. A cost model may be needed to assist LTA in the determination of a “reasonable” price or maximum price for wholesale and retail access on a cost plus basis, or on an internationally acceptable basis for capacity resale in these circumstances. This may require the introduction of a glide path towards the maximum prices which can be charged during at least the first several few years after ACE Ready For Service date, to be updated on a periodic basis. Alternative price regulation strategies are available may be implemented by to LTA. For example, maximum prices can be set which would fall rapidly during the first several years as expected volume of capacity usage increases while costs remain relatively static. Alternatively, a relatively flat schedule of prices may be introduced in over the first several few years of time, which provides a substantial incentive for operators to increase volume.

- *Transparent plan.* We believe it will be important for LTA to issue guidelines sooner rather than later, indicating what steps it may take to create a suitable regulatory framework for access to the cable and related facilities, access to associated networks, and the cost of capacity.
- *Accompanying steps.* The necessary public consultations and market and cost research should accompany each step.
- The other suggestions made and issues raised by operators are less obviously appropriate at this time, or at all, for the reasons set out below (largely related to timeframes and market structure). These other “operator issues” include⁶²:
 - *Clear definition of public/private partnership within the context of ACE and national terrestrial cable infrastructure.* We have considered the PPP-type structure briefly and do not believe that this option is either commercially appropriate or in the circumstances, expedient. The varying interpretations of what might constitute a PPP in the Liberian context and in the context of ACE seem to support this view.
 - *Detailed information on the ACE cable project, its financiers and options for entry time frames.* As we understand it, this information now rests directly with the operators themselves and they are liaising directly with the ACE IMC.
 - *Effective regulation concerning the unbundling of the local loop that ensures that incumbent operators provide access to competitors to local copper loops on fair, reasonable and non-discriminatory terms and grant physical access at any technically feasible point on the copper loop, including collocation, at cost-based prices.* This requirement is misplaced at this time, given both Libtelco’s current status, and the focus of the consortium on gaining access to international capacity. Unbundling the local loop does of course, in other countries, constitute one form of ensuring competitive access. In Liberia until Libtelco is truly a going concern with market share, there seems to be no reason at all to tie the regulation of a cable consortium in relation to the landing point, to the unbundling of the local loop. In due course (possibly in 3-5 years) this will be relevant. It is possible that Libtelco’s assets including rights of way, ducts and trenches, might be useful in measuring or “paying for” its participation in the consortium, if considered to have “financial” value, but we are concerned that focusing on this issue will distract from more important landing point issues such as ensuring that Lonestar’s and Cellcom’s market dominance is not used to discourage a decline in internet access prices.
 - *LTA must publish prices, terms and conditions for local loop unbundling to include: setup/connection fee (in each case), shared access (voice only), shared access (data only), and full access (voice and data).* Our comments above apply equally here, save to say that in a brief assessment of the points raised and without the benefit of further discussion with the operators, it is unclear how and when they would expect LTA to undertake this sort of study. In our view, the cost studies associated with the regulation of cable access and sales of capacity are a priority. In reality the timing of both studies may be simultaneous.
 - *Infrastructure-sharing by the provision of competitive carriers access to in-house wiring through “co-mingling” in which the incumbent prepares a common facility where competitive providers can install and operate their own equipment or “neighbour co-location” services, in which the incumbent prepares a facility outside the building hosting its own facilities.* We are unclear as to whether the operators are referring to Libtelco as “incumbent”, or to CCL in due course. This is obviously important as regards CCL, and we also consider facilities-sharing as a concept to be

⁶² “Issues of Concern to Operators Regarding the ACE Submarine Cable Project”, document given to LTA by operators in early March 2010.

very important within Liberia in relation to all operators. The interconnection regulation gives some indication of how this might be handled. The general principles of co-location should be considered by LTA as soon as possible, and we understand that this is in fact already being considered.

- *LTA must prepare a regulation stipulating that data transmission be provided with a minimum speed of 128kbit/s and it should be guaranteed to all households in Liberia.* This is an interesting point and one which we consider should be addressed in the context of considering what constitutes “universal service” and “universal access” for Liberia. We do not consider this issue to be related only to the cable, but to all capacity. Determining a minimum speed is a complex matter, requiring consultation. This should not be determined in a hurry.
- *Broadband should be made available to all operators/telecom providers at the same price. A fund should be established to be managed by LTA which would subsidise the difference in broadband connection costs between rural and urban areas. This would allow small and medium-sized enterprises outside large urban centres to access broadband networks at the same price as their urban counterparts.* This also relates to a consideration of universal service and particularly to the funding of universal service obligations. Pricing for access to capacity on the cable will be regulated not as a universal service, but in accordance with price regulation principles applicable as a result of the nature of the cable landing point (as essential facility) and the status of CCL as “dominant” and member operators as having exclusive access to capacity on the cable under the CCL agreement.

APPENDIX 6: LEGISLATIVE, REGULATORY AND COMMERCIAL CONSTRAINTS ON INVESTMENT

There are numerous impediments to private investment in telecom sector in Liberia, most of them systemic. Constraints limit the ability of operators to invest in telecom infrastructure to provide low cost service to Liberians, which thereby constrains Liberia's ability to distribute ACE capacity and bridge the urban – rural divide. Equally importantly, it increases the need for GoL support and investment to address these issues, thus increasing the burden on GoL. This Appendix identifies these impediments and proposes actions to eliminate the impediments.

In other countries grappling with the need to accelerate the rollout of broadband, the main broadband deployment constraints are often determined to be:

- Bandwidth availability.
- High cost of bandwidth (particularly international).
- The prevailing licensing regime and various licence costs.
- Spectrum constraints
- Low levels of PC penetration and ICT literacy
- Inadequate infrastructure, including electrical power

The main broadband uptake / usage constraints are:

- The quality of broadband services (more important to the business market segment).
- The geographic availability of broadband services.
- The high cost of retail broadband services (particularly among residential users but also small companies).

By far the least expensive way for GoL to achieve rapid roll out of telecom infrastructure and rural telecom service is to unleash the power of private investment by making it as easy and profitable as possible for operators to invest across the country on a commercial basis without GoL support.

Of the many obstacles identified, the most important is the lack of power generation and electricity grid across Liberia, including in rural areas. As noted below, this substantially increases the operating costs of all operators and strongly limits their ability to roll out infrastructure and willingness to invest in rural areas.

1. LEGISLATIVE AND REGULATORY IMPEDIMENTS

The 2007 Act was developed under a World Bank project and is in general, a very good telecom law.

This section summarizes the aspects of the Act that may be impediments to investment in the sector and proposes actions to reduce or eliminate the impediments.

1.1 Regulatory Uncertainty Increases Risk of Investment

Regulatory uncertainty reduces the ability of operators to predict regulatory outcomes which will impact their investments. This impediment, while still substantial in Liberia, is lessening in importance as the new Board of Commissioners of LTA has succeeded in adopting regulatory frameworks for interconnection and access, consultation and dispute resolution. However, until LTA adopts a full

complement of regulations, and provides a record of stability and independence over time, regulatory uncertainty will continue to weigh on operator investment decisions in Liberia. In particular, operators are deeply concerned that political pressure may result in a process to set the fee for the license for CCL which is not transparent and an unreasonable cost to upgrade their individual licenses to universal licenses, which is required to permit them to implement the 3G technologies needed to distribute ACE capacity on a cost-effective basis.

Uncertainty can also be created where regulations are not yet in place, or where changes are proposed to regulations, licences or laws, which are not consulted on adequately.

Recommended Action to Eliminate Impediment: The technical assistance to be provided by World Bank to LTA to establish a clear regulatory regime for CCL and operators (detailed in Appendix 5 of this Report) will substantially address this concern, however this obstacle to investment will only be fully addressed with the passage of time as LTA implements a full cadre of regulations and maintains its independence across several consecutive boards of commissioners. It will also be appropriate for LTA to maintain a good body of precedents and ensure certainty by deciding similar matters along similar lines. Where regulations are required or where changes are proposed, maintaining clear lines of communication, making public any work plans, and allowing sufficient time to consult will be important.

1.2 Reasonable License Fees and Frequency Fees

CCL will require a license in order to operate the landing point and distribute internet access in Liberia. If set too high, such fees will reduce operator funds available to invest in telecom infrastructure to distribute ACE capacity. In addition, in order to roll out the wireless, 3G and NGN technologies needed to distribute ACE capacity, which will be particularly necessary in rural areas, Liberian operators will require upgrades to their existing licenses to either universal licenses (recommended) or 3G. The fees for both CCL cable landing point and universal licenses should be set based on international best practice. The World Bank project preparation funding for technical assistance to LTA will provide support for the licensing of CCL and possibly for upgrades to licenses of the operators which will distribute ACE.

Recommended Action to Eliminate Impediment: Develop licensing fees and regime for CCL and operators which are based on international best practice and benchmarking of fees in comparable jurisdictions with a view to minimizing licensing fees and encourage operators to invest as much as possible in infrastructure.

1.3 Independence of Telecom Regulator

One of the most important foundations for a vibrant and competitive telecom sector market is an independent regulator. This is recognized in the Telecom Act and the independence of LTA is provided for in Part III (The Liberia Telecommunications Authority (Articles 8-11) of the Act. The independence of the regulator ensures that new entrants are treated fairly by both LTA and existing operators – given that new entrants often provide critical competition, introduce new technology to the sector, and serve markets which larger established operators do not serve, their role is important is critical to supporting and expanding service in rural areas. Unfortunately, regulators in some countries at times come under government pressure when determining fees for new licenses or exercising other aspects of their authority

Recommended Action to Eliminate Impediment: In order to further confirm LTA's independence, we recommend that the Act be amended to clarify the independence of financing for LTA's operations. In order to further insulate LTA from political pressure, this funding should ideally come exclusively from license and other operator fees paid to the central government fund and allocated in accordance with Ministry of Finance guidelines.

1.4 National Operator Provisions in Draft ICT Policy

Libtelco was designated a National Operator historically, and any other operator may be designated as a National Operator under Section 12 of the 2007 Act⁶³ and that the Ministry and LTA may jointly issue directions from time to time regarding the obligations of National Operators. The current policy that supports the government's poverty reduction strategy defines the national operator by establishing a broad range of objectives addressing poverty reduction, universal access, support for broadband, ensuring secure GoL networks among others.⁶⁴

The Consultants discussed in the intent of the Act and Policy with Zotawon Titus, Assistant Minister for Telecommunications, Ministry of Posts and Telecommunications. Assistant Minister Titus confirmed verbally that the intention at the time of drafting of the Act was that, on closing of any privatization of Libtelco, the Act would be amended to eliminate the designation of Libtelco as a National Operator and that no special obligations would therefore be placed on Libtelco. However, Assistant Minister Titus advised the Consultants that the Act will still permit the Minister to designate any operator as a National Operator at any time in the future, with attendant obligations.

Imposing as yet undefined obligations on any Liberian operator including Libtelco or in the future (potentially all Liberian operators) as a National Operator would be of substantial concern to any investors in or lenders to these companies, and will substantially limit any privatization interest in Libtelco. It is well-known that lenders crave certainty in order to measure investment risk and determine returns. Without either identifying the obligations and limiting them, or removing the possibility that such

⁶³ *National Operator Provisions in the Act:*

12. Telecommunications Licensees and National Operators

(3) A licensee may be designated by the LTA to be a "National Operator". The purpose of National Operator designation is to ensure that identified national or public interests, such as the provision of secure telecommunications networks and services to Government departments, are met and that sector policies are achieved. Designations of National Operator status may be reviewed, revised or revoked, in accordance with the direction and consultation procedures described in Section 12(4);

(4) The particular rights, responsibilities and consequences of being designated a National Operator shall be defined in directions issued jointly by the Minister and the LTA. Those directions shall be determined following an assessment of whether market forces are sufficient to meet the identified national or public interests, including any consultation to be conducted pursuant to Sections 7(1) or 11(4).

(5) A National Operator shall not be granted any competitive advantage over other service providers; and except as otherwise specifically provided in this Act, a National Provider shall subscribe to and be governed by all provisions of this Act and all regulations, rules and orders promulgated by the LTA.

In addition, Section 13(2) of the Act designates Libtelco as a National Operator and provides that the Ministry and LTA may provide directions from time to time regarding the obligations of national operators:

13(2). Liberia Telecommunications Corporation

As indicated in Schedule A to this Act, the Liberia Telecommunications Corporation is designated a National Operator as of the commencement date. The Liberia Telecommunications Corporation's rights, responsibilities and consequences of being designated a National Operator shall be defined in directions issued jointly by the Minister and the LTA pursuant to Section 12 (4).

⁶⁴ These objectives include: Support the poverty reduction strategy; Provide networks to support universal access when called upon by the LTA; Pay the appropriate government taxes on goods sold and employees' income tax; Pay all regulatory fees and charges as well as contribute to the Universal Access Fund; Report to the Ministry of Finance any and all annual capital gains and/or net earnings from participation in any of the competitive markets; Support the provision of broadband communications systems and networks; Support the provision of international gateway network; Develop transmission networks using terrestrial technologies like fiber optics and cable systems; Develop, deploy and maintain the national land based infrastructure; Provide high speed data transmission and real time information sharing communication systems; Ensure government networks are secured and reliable.

obligations will be imposed in the near future, lender interest will be reduced, or rates they lend at increased to address the perceived risk, even if remote.

The Consultants understand that the Minister and LTA to date have not issued any directions under the Act regarding the responsibilities and consequences to Libtelco of being a National Operator, it is the only such operator at present. However, Part II, Section 7 of the GoL's Policy for the Telecommunications and Information Communication Technology (ICT) Sectors (the "GoL ICT Policy") provides an indication of potential directions which the Ministry and LTA might issue in this regard, with a view to implementing or giving effect to national policy. A potential investor can be expected to assume that this policy will be implemented unless provided clear assurances by GoL otherwise.⁶⁵

Recommended Action to Eliminate Impediment: We recommend that Libtelco's status as National Operator be terminated as soon as possible and that the ability of the GoL to designate any operator as a National Operator be deleted from the Act. For certainty, the Consultants note that the Act must also be amended to delete Article 13(2), which designates Libtelco as a National Operator, and delete Article 12, which authorizes the designation of any licensee as a National Operator at any time unless the Article is amended to stipulate the circumstances in which such a designation may take place, and the type of obligations that might be imposed upon a service provider designated as a National Operator. The other substantially less attractive option, is to maintain the designations but clearly limit the extent of these obligations as to scope and time of application, to reduce risks to banks and other potential lenders.

⁶⁵ Government of Liberia's Draft Policy for the Telecommunications and Information Communication Technology (ICT) Sectors (February 2009 Draft).

1.5 Reallocation of Spectrum to New Technologies and New Entrants

Article 24 (1) (Spectrum Management Functions) of Part VI (Radio Spectrum Management) of the Act, states that “the LTA shall be responsible for the orderly and efficient management, allocation, assignment and use of radio frequencies, including all civilian, non-civilian and commercial uses of radio frequencies.” Given that new technologies such as WiMAX will likely be the least cost methods of rolling out telecom service to rural areas, it will be important to ensure that frequency is available to existing and new operators to support roll-out of these technologies. If not forced to “use or lose” frequency efficiently, operators and governments tend to hoard and use excess spectrum allocations inefficiently. OFCOM, the U.K. regulator, completed a review and substantial reallocation exercise in 2009, resulting in meaningful changes to its spectrum allocations to support new technologies.

Under Article 20 of the Liberia Telecom Act 2007, the LTA may alter licenses (in this case a telecom license with annexed spectrum authorizations) to ensure compliance with International Treaties, i.e. ITU Radio Regulations and decisions such as WRC-2003 and 2007. If a change is to be made, specific procedural steps are prescribed. Under Article 25, the LTA is responsible for efficient management of the radio spectrum. The conduct of spectrum demand studies is an evolving best practice, usually with a 5 year and 10 year view. The LTA is required to plan and hence should be developing band plans in anticipation of future needs.

Recommended Action to Eliminate Impediment: We recommend that LTA adopt spectrum regulations to facilitate LTA’s review of spectrum allocations to ensure spectrum is being used efficiently; no amendments to the Telecom Law are necessary. Such spectrum regulations were drafted in 2006 and redrafted in 2008 by international experts with LTA, but have not yet been implemented. These regulations should be updated to ensure that they address the need to review, re-allocate and re-farm spectrum based on a consistent, transparent and principled process addressing utilization, efficiency, economic and technical impact, and other issues. This review should include spectrum reserved for use by GoL (for example for security purposes) and that allocated to licensed operators. Any frequency that is identified as being inefficiently used, or requiring reallocation to support new technologies could then be reallocated to more efficient use.

1.6 General Authorizations Rather Than Licenses to Service Providers

International best practice in licensing has advanced substantially since the Act was developed in 2006/2007. Current practice is to require that service providers obtain licenses only if the provider required scarce resources (spectrum, numbers, land, or rights of way for example) in order to provide service. This is because licensing can be regarded as a barrier to entry – it takes time to prepare an application and have the application considered, and there is a cost attached to an application. It is also often the case that regulatory authorities consult on the grant of licences, permitting objections to be lodged by existing licensees which may result in exclusion of competitors in future.

Operators such as fixed line operators and ISPs should not be required to obtain licenses where the market is fairly competitive or their likely impact on the social or economic environment in which they will operate is limited. Rather, service providers need only register or notify the regulator, pay a small fee, and then ensure that they meet the ongoing requirements for that type of service as laid out in general regulations established from time to time by the regulator. Elimination of onerous requirements associated with licensing facilitates new entrants and potentially, more innovative services, and enables these operators to compete with services of those other operators. The EU moved to this approach to licensing several years ago with positive results. This approach also reduces the regulatory burden on LTA, leaving it better off in terms of time and resource, to apply itself to other important regulatory considerations including, for example, the determination of dominance, and creation of an appropriate regime for access.

Recommended Action to Eliminate Impediment: Amend the Act to eliminate the requirement that all service providers obtain licenses or create two categories of licence – an individual and a class category.

Require only operators which use scarce resources such as spectrum, number or land or those which have or are likely to have a significant socio-economic impact to obtain individual licenses, the remainder need only register or notify LTA that they intend to provide service and they should then be required to comply with published terms and conditions of general application – they will be authorized under a class licence.

1.7 Interim Designation of ACE Cable Consortium of Liberia as an Essential Facility

In order for LTA to regulate the prices of CCL, which will sell international connectivity capacity on a wholesale and retail level, CCL must be designated by LTA as an Essential Facility or operator having dominance in the market for cable landing point services. Article 27(1) (Functions and Duties of LTA Regarding Competition) provides that the LTA shall make orders defining markets and make orders designating dominant service providers in relevant markets in Liberia, based on their market share and other factors as determined in accordance with regulations, rules and orders. Best practice has developed which involves the regulator conducting a market analysis exercise to make this determination, which is sometimes challenged by the designated operators in court.

Elimination of Impediment: If there appears to be any uncertainty regarding LTA's ability to complete this market analysis and issue this designation, we recommend that CCL be designated as an essential facility by way of an amendment to the Act determining all cable landing points to be an Essential Facility on an interim or transitional basis until LTA has completed a market analysis of the facility to determine if a separate market exists (it obviously does) and that CCL has dominance in that market (it obviously does). This would avoid a potential situation where CCL might challenge LTA's authority to regulate the prices of CCL. Such transitional provisions are common in new telecom laws and make sense for this new facility, unless it is clear that LTA will complete its market analysis prior to launch of service by CCL in late 2012 and be ready to regulate essential facilities.

1.8 Validity of LTA Decisions During Appeal

Article 78(2) of the Act states that LTA may enforce any LTA order without a court order. Article 81(3) however, provides that a petition for judicial review shall stay all further proceedings and / or actions in the matter until a final determination thereof is made. In the past, this provision has been used by operators to simply delay LTA's exercise of its authority. In effect, LTA's authority has been stymied.

Recommended Action to Eliminate Impediment: We recommend that Article 78(2) of the Act be amended to state that LTA's order remains in effect during any court review until a final decision is made on the matter. This will support LTA's ability to effectively regulate the sector and support a competitive market environment.

1.9 Infrastructure Sharing, Access and Interconnection Regulation

Duplication of important infrastructure is not only costly but has adverse implications for the environment. It is becoming the norm in other countries where competition is more prevalent, to require operators to share facilities or require existing major licensees to grant access to their facilities and premises to new entrants and smaller licensees. This not only reduces the cost of rolling out networks (allowing operators to divert resources to areas where no infrastructure exists, or to upgrade or improve existing facilities and services), but ensure the most efficient use of existing facilities. Ducts, poles, masts, sites, cables, and similar infrastructure is capable of being accessed and used by several operators. Trenches can be shared by numerous cables. Disputes between operators have in the past, frustrated infrastructure-sharing, as has uncertainty about appropriate charging regimes.

LTA does not sufficiently force provision by operators of Points of Interconnection outside Monrovia – so all Rural to Rural calls must be routed back to Monrovia and then to rural area, adding expense. This failure encourages telecom operators to avoid investing in infrastructure in rural areas, blunting Government's ability to implement eGovernment in these areas. LTA must support access to each

operator's critical infrastructure, to ensure that all operators benefit from ACE or whichever international connection is obtained for Liberia. Little would be gained if Libtelco and other operators brought ACE landing point to Liberia but then charged high rates for access, or provided limited access. Although the interconnection regulations also provide direction on access, more is required focused specifically on infrastructure such as shared use of the landing point, access to Libtelco duct system at reasonable costs, use of any Monrovia broadband network (regardless of who builds it). Failure to do so will limit the availability of international broadband connectivity in Liberia, limit proliferation of internet access and therefore limit internet usage and success of eGovernment initiatives (including eEducation, e Health, etc).

Recommended action to eliminate impediments: the LTA regulations regarding interconnection and facilities-leasing must be implemented without delay. LTA should publish guidelines indicating in what circumstances it will expect infrastructure-sharing. Costs of this sharing should be proven by the party seeking to avoid sharing, so that the actual cost of provision as opposed to the cost of construction or an unrelated figure, can be approved. Dispute resolution can now be handled under the LTA dispute resolution regulations, and delays of any sort by licensees in responding to requests for information or to dispute resolution calls, should not be tolerated. If necessary LTA must impose penalties on non-compliant operators as a warning and incentive to comply in future.

2. COMMERCIAL IMPEDIMENTS

2.1 Lack of National Electricity Grid

The absence of a reliable and reasonably priced supply of electricity in Liberia is the most critical impediment to investment in telecom infrastructure, particularly in rural areas. All providers require their own generators, plus ideally two back-up generators, plus technical maintenance team to service the generators, and steady source of fuel, which varies in availability and price. It is impossible to accurately assess the additional costs that this impediment imposes on telecom service suppliers. However, major operators reported to the Consultants in June 2010 that fuel represents between 40 to 60% of their operating expenses. In addition to this cost, operators must buy and maintain electricity generators.

Recommended Action to Eliminate Impediment: Reinforce the national commitment to invest in electricity infrastructure across Liberia. Focus this infrastructure on identified Development Corridors. Look to share infrastructure rollout costs with telecom operators where possible, under concession agreements, for example by stringing fibre optic cables alongside electricity cables.

2.2 Customs and Other Duties on Import of Telecom Equipment and Computers

High customs duties on the importation of technology can have the same type of inhibiting impact upon both telecommunications sector growth and medium to long term economic opportunity, including Government revenues. The public income resulting from such tariffs in the short term is almost certainly less than the Government would receive from the expanded business activities that can result from faster ICT industry growth.

In general, however, import tariffs on telecommunications equipment and technology are quite high and restrictive. The customs duty on imports of terminals, computers, and handsets is in the range of 20-33%. In addition, VAT of 17% is payable on this equipment. These taxes impede investment in new telecom equipment and create barriers to access by consumers due to the resulting increased cost of service and handsets (which must incorporate the taxes). The high duties and taxes also encourage corruption at Liberian ports and entry points by providing an incentive to smuggle in these goods without paying duty or VAT.

In order to encourage the import of telecom equipment and other ICT infrastructure, some countries charge reduced or no customs duties on telecom and related equipment. For example, Tanzania charges no customs duties on imports of computers, which resulted in increased internet usage. Botswana has substantially reduced or eliminated customs duties on import of various telecommunications equipment.

Reducing or eliminating these tariffs would increase investment in the sector (increasing services and lowering prices to consumers) and increase Government revenues via less corruption and expanded economic growth from the greater investment this would encourage.

Recommended Action to Eliminate Impediment: Eliminate or substantially reduce customs duties and VAT on all imports of computers, telecom equipment and handsets for a specific period, for example 5 years. GoL should encourage operators to obtain equipment certification from LTA and LTA should in turn, create streamlined procedures for certifying equipment for this purpose. We understand that for ACE-related equipment, GoL is willing to allow CCL to bring in equipment in tax-free. Operators which obtain a universal license or 3G licence in due course should then also receive tax incentives for roll out of infrastructure (limited to telecom equipment, not supporting infrastructure or building materials for example). This will require the co-operation of customs and the Ministry of Finance. To avoid abuse by operators of tax-reduced import permissions, any operators importing telecom equipment and requesting reduced tax must obtain certification by LTA that they are in fact importing telecom equipment.

In addition, we recommend that GEMAP type discipline be imposed on the Customs Authority to ensure there is no corruption at the Port of Monrovia and other entry points for telecom equipment.

2.3 eBanking and eCommerce

To enable ATMs and financial institutions in rural areas and Monrovia, which the policy identifies, existing barriers must be eliminated such as lack of eBanking legislation, eSignature, eCommerce legislation, etc. and lack of access by all operators to Libtelco's duct system (due to lack of clear access-to-infrastructure regulations which LTA then firmly enforces). In addition, mobile operators must be encouraged to provide eBanking in rural areas. There are substantial obstacles to this now: mobile operators must be licensed or authorized to provide basic banking services or partner with banks. As Kenya and other countries have shown, ebanking via mobile phone companies can provide a real driver for rural telecom service, eGovernment, etc. eBanking provides a cheap vehicle for remittances from Monrovia and abroad direct to rural areas supporting rural development. This demand will provide telecom operators with the commercial incentive to build infrastructure in rural areas which eGovernment requires. We understand that Central Bank does not have the capacity to manage mobile banking process.

Recommended Action to Eliminate Impediment: review laws to determine where improvements can be made or if new laws are required, and start this process. Review demand and consider an education programme in conjunction with banks and operators, to increase the number of consumers with bank accounts and phones. Consider how to capacitate the Central Bank over the next 2-3 years, alternatively to create bank agents which can be authorized to sanction transactions up to a particular limit, or to facilitate transactions for operators of a certain kind, such as transfers. Mobile banking is a project of such significance that further work should be done in this regard to determine how best from a technical, legal and commercial perspective, this may be supported and implemented in Liberia. Such a project will require co-operation between LTA, the Minister of Communications and Finance, and other stakeholders in the banking, communications, and consumer sectors.

2.4 Encouragement of Enabling Environment to Support Internet Usage in Liberia

Successful implementation of eGovernment requires the proliferation of internet access in rural areas as well as in Monrovia, as well as higher comfort level by Liberians in using internet and interesting content on internet to encourage Liberians to use internet. On its own, provision of eGovernment will not get Liberians flocking to use the internet. Liberians will not push to obtain access, or be comfortable using the internet if eGovernment is one of the few main drivers for internet use and there is little else interesting to use internet for. “Foundation requirements” for the success of eGovernment include the following:

- Supportive regulatory regimes and laws
- International broadband connectivity (ie. ACE cable landing point or other)
- Access by all operators to this international connection (not just access by Libtelco)
- Interesting content (in most countries this means local and international content).

It is not clear that the Government understands how all these existing obstacles work together to frustrate investment in rural access, and further work is needed to develop an Action Plan to resolve these basic problems.

Recommended Action to Eliminate Impediment: the steps to be taken in this regard have largely been covered in other sections, save to reiterate that education will be critical in incentivizing internet uptake.

2.5 Constraints on Operator Access to Financing for Infrastructure Investment

Operators in Liberia fund their investments using a variety of sources, including:

- borrowing funds from local banks;
- obtaining funds from parent or related companies (for example funding by MTN to Lonestar);
- equity investment by venture fund (for example Equity Capital Partners investment in Cellcom);
- sale of financing instruments to the Liberian public (for example the convertible debentures sold by Cellcom to Liberian public in 2009 and 2010);

Interest rates for lines of credit from Liberian banks are in range of 12-14%, with approximately 1% fee on undrawn amounts. This high rate reflects risks in the Liberian market and recent losses by these banks during the recent downturn. However it also results from the limited capital invested in the Liberian banking system, which limits the funds available to lend, and high costs within the banking system due to lack of low cost internet access (which limits ability of banks to monitor loans outstanding among other things), ePayments system and other factors.

Recommended Action to Eliminate Impediment: We encourage GoL to consider measures to encourage increases in the capital and lower costs within the banking system, for example:

- License additional banks including foreign or international banks, and remove requirement that banks have all operations within Liberia;
- Encourage development of banking systems and marketing programmes to capture deposits and pay interest on funds of both urban and rural residents who are often recipients of substantial international remittances;

- Implementation of ePayments system now being reviewed by GoL;
- Investment by banks in internal internet networks to support funds transfers and reporting.

2.6 Rural Areas: Impediments to Investment and Market Development in Rural Areas

This section identifies additional obstacles faced in provision of telecom services in rural areas of Liberia compared to urban areas, given the growing importance of e-banking as a component of rural development (to provide rural residents with access to basic banking services in small villages as Vodafone in Kenya does, including remittances from relatives, small loans, microfinance)

Market impediments are conditions in the telecommunications marketplace, which create barriers or restrictions for investors, operators, customers, and others to realize the full potential for supply and demand. These tend to be “artificial” impediments, which do not result from unavoidable or “natural” conditions in the sector, but from factors which have arisen to block market development, and which could be removed or reduced through enhanced policies and practices by various stakeholders, including the LTA or the Government.

2.7 Lack of Other Basic Infrastructure in Rural Areas

In addition to the lack of stable and affordable electricity across the country, most rural areas of Liberia lack other basic infrastructure needed to support the construction and operation of local telecommunications networks and services, particularly in rural areas where a large percentage of the population is located. Examples of this lack of infrastructure include:

- Limited road access, making transportation of fragile equipment and regular visits by skilled maintenance and repair personnel difficult; Maintenance and repair costs are very high.
- Lack of airport service, making travel expensive because other more costly alternatives, such as a corporate helicopter, are required where no commercial flight service exists;

This lack of basic infrastructure makes providing services in these areas more expensive and challenging. Even where this infrastructure is available, it is often only available at relatively high costs, in turn increasing the cost of service to customers or making provision of that service unviable.

Recommended Action to Eliminate Impediment: It will be especially important to ensure wide coordination between different branches of Government, as well as the private sector, in infrastructure investment and upgrade programs, especially as new technologies and network are introduced further into rural regions. Ideally, where construction projects are contemplated, such as roads, railroads and electricity, these can be tied together with planned rollouts of telecommunications networks and services, to minimize duplication of effort and costs. The rehabilitation of the railway from Buchanan to Nimba under concession agreements provides an important opportunity to “piggyback” on other infrastructure development to expand Liberia’s national backbone. The Universal Access Fund could play a leading role in promoting such coordinated efforts.

2.8 Limited Knowledge about ICT for Development among Policy Decision Makers

Many key decision makers who play a role in approving and implementing ICT policy and programs in Liberia have limited knowledge of fundamental ICT issues or have insufficient technical support teams to advise them on key decision items. To avoid delays in the decision making process, which can be detrimental in a dynamic sector such as telecommunications and ICT, it is critical to build the technical capacity of both the technical commissions associated with Parliament and the Council of Ministers, as well as Parliamentarians themselves.

Recommended Action to Eliminate Impediment: Decision makers must be fully informed about the benefits of ICT for development, particularly the role of ICT as tools to facilitate development across sectors. For this reason, we recommend the development and implementation of **a program to identify ICT Champions with the responsibility of increasing awareness and promote the use of ICT in the development of Liberia.** These Champions, who may also be Government representatives, would be charged with raising awareness and educating different groups about the benefits of ICT for development. As part of this program, a custom training activity should be developed for policy and decision makers alone, to provide them with the capacity to make informed decisions.

2.9 Lack of Trained ICT Professionals Outside Urban Areas

There are virtually no technical support companies available to maintain and repair ICT equipment outside main urban areas of Liberia.

This problem extends generally to ICT awareness, skills, and capabilities among the population and workforce in non-urban areas. This makes it difficult to introduce technology into small businesses and other institutions, and restricts potential near-term demand for services, particularly higher-end ICT applications. Any initiatives to promote infrastructure, telecommunications and ICT connectivity, and especially e-Government types of development must incorporate capacity and awareness-building programs aimed at supporting both consumer and especially professional capabilities.

Recommended Action to Eliminate Impediment: Based on experience elsewhere in Africa (e.g., Mozambique), it seems that partnerships with local institutions are a key component to successful universal access projects in rural and remote areas. Local institutions have greater knowledge of the communities, understand the market better, and have links to the community that are necessary to ensure success and adoption, including staff that can be trained and secured to address technical needs of ICT projects in the area. Partnerships are particularly beneficial as they provide a model for sharing infrastructure, management and critical technical staff at all times, even when that technical staff is trained and paid by the service provider.

2.10 Lack of Relevant Information Content

As in much of the developing world, there is a serious lack of digital information content available to support the expansion of advance ICT services and applications, especially for rural Liberia. Beyond the Internet, computer software applications and other forms of multimedia content need to be developed that are of value and interest to the Liberian population: ideally, by encouraging and supporting development of content by local Liberians themselves. To accomplish this will require even greater focus on training and education, with an emphasis not only on actively utilizing technology, but employing it in creative and innovative ways that contribute to community life. LTA should actively participate in efforts to encourage such content development initiatives, through Universal Service funding, incentives for operators, cooperative programs with other institutions, and public awareness raising efforts wherever possible.

Recommended Action to Eliminate Impediment: It is important to facilitate access to information via the internet. However, such information needs to be relevant to rural populations and provided in a format that is clear and understandable, including in the required languages and/or formats that make it accessible to a wide diversity of groups (e.g., video, spoken language). Local and meaningful content is critical to ensure demand for and a market for ICT services and applications. It can serve as an opportunity to build local capacity and/or support local businesses interested in content development for their communities, and delivered via ICT networks, including radio. Therefore, we recommend that a program focused on the development of Content and Applications be implemented and funded through the strategy to bridge the urban-rural divide and integrated into a wide universal access strategy in Liberia (see Appendix 7 for details).

APPENDIX 7: RECOMMENDATIONS TO BRIDGE URBAN-RURAL DIVIDE

1. PROPOSED STRATEGY TO FACILITATE RURAL CONNECTIVITY AND DEVELOPMENT IN LIBERIA

In developing a broadband access strategy in the communications sector, it is important to recognize that it reflects two dimensions: a long term vision for access and short term goals leading to the achievement of that vision. This proposed strategy provides **a framework for a long-term vision of access, focused on short-term goals and objectives for a period of 3-5 years**. It considers the current status of access in Liberia (as discussed above) as well as the proposed development of the national fiber backbone infrastructure along Liberian development corridors for the next 5 years. This strategy recognizes that roll-out of infrastructure to distribute broadband internet access to rural communities outside of county capitals will not be prioritized until after county capitals have been connected, for the reasons stated earlier in this report.

Accordingly, the focus of this strategy will be on the development and implementation of a series of **pilot projects** to build the capacity for rural residents to use and benefit from internet access, and also to test the efficacy of various connectivity options (such as telecentres) for rural communities.. Although we recommend that the majority of UA Fund financing be used to fund larger telecom infrastructure-based projects, we recommend that some UA Fund subsidies be provided for various pilot projects in rural areas. These projects would be implemented in rural and under-served or un-served areas only, with special consideration to those areas with high population density (e.g., the North East part of the country) and not reached by the plans to extend the fiber/broadband backbone along the development corridors. However, it will be critical to ensure that some infrastructure is available at least in selected areas and that connectivity is a possibility in the medium and longer term, not just through current and planned infrastructure, but through new access options such as those provided by O3b or other wireless options provided by operators, such as WiMAX.

We recommend that this rural connectivity strategy be implemented as part of the national universal access strategy summarized in the recent ICT Policy, by the ICT4D Committee in concert with the administrators of the Universal Access Fund.

This proposed strategy is based on two important assumptions, which our earlier chapters and appendices recommend be implemented:

1. That the Universal Access/Service Fund will be established and become operational in 2011 or shortly thereafter; and
2. That there will be sufficient infrastructure in representative rural areas (for example by way of O3b) to allow for the implementation of the proposed plan of action.

If the above assumptions are not met, the GoL will face delays in bridging the urban-rural divide, particularly to provide access in areas currently un-served and/or far too remote for operators to reach.

The proposed action plan to bridge the urban-rural divide, which is included in Appendix 1 establishes key goals for the UA Fund with respect to rural Liberia and focuses on the implementation of pilot projects in this first phase of the UA Fund's operations. This approach allows the UA Fund to start implementing this strategy while at the same time using the process as a learning and capacity building experience which can be applied more broadly as rural connectivity is expanded over time. The recommendation to focus on pilot project implementation in the first 3-5 years of the Fund's operations is based on the following beliefs:

- The implementation of pilot projects will allow the UA Fund to test the demand for and infrastructure for ICT access in rural areas.
- This strategy is developed to create a built-in capacity building program for LTA as the implementing UA agency, as LTA needs to gain experience in a complex set of tasks and responsibilities, including strategic planning, project development and design, the development of terms of reference, bidding processes, collaboration among entities, implementation and evaluation of projects and programs, active involvement in demand stimulation projects, among others responsibilities.
- Pilot projects provide a platform to test and assess different approaches to project implementation, such as PPPs, the use of which could be expanded if successful on a pilot project basis.
- After a 3-5 year period, with the accumulated experience from the pilot projects and a large percentage of the backbone infrastructure in place, including efficient connectivity to ACE capacity, the Fund will be better positioned to develop and plan rural projects that take full advantage of the available capacity and will better respond to the ICT needs of rural populations

This broadband access strategy should be implemented through a sequence of steps and projects, phased in through the 3-5 year period, while building on their mutual operational experiences, the accumulated capacity of the UA Fund's staff and on the infrastructure available. For example, our strategy proposes that a small number of pilot internet access centers be implemented in the first year of Fund's operations and that additional projects be implemented once these are capable of providing the necessary access and infrastructure to support the implementation of additional projects, such as an ICT capacity building project or a School connectivity project. Critical to this approach is the opportunity to develop and strengthen collaboration and partnership among stakeholders and users so that the benefits of ICT access in rural areas is maximized. To ensure the success of the program, the UA Fund, administered by LTA should work closely with other stakeholders such as the ICT4D Steering Committee to implement a series of demand stimulation measures (see below for additional details).

This rural development strategy must be revised and updated in 3-4 years to reflect developments in the sector, lessons learned from the proposed program (through the ongoing evaluation of projects), and the experience and capacity of the LTA as it leads implementation of the program.

1.1 Objectives

This section describes the proposed objectives and components of the recommended strategy to facilitate rural development in Liberia in the next 5 years. These objectives form the basis for the proposed Action Plan under this strategy (see Table below for details). Further analysis and support is required to develop the programs further and devise an implementation strategy for each. These objectives may be extended, revised or changed when the universal access strategy is revised in 3-4 years (in preparation for a new 5 year period). Objectives should reflect developments in the sector as well as lessons learned through the implementation of the strategic plan.

1.1.1 Expand rural telecommunications infrastructure and access to rural areas of Liberia, with a focus on public shared access to multipurpose ICT facilities.

The Universal Access Fund should be used to support the establishment of Multipurpose Public Access Centers (MPACs) in locations where public access to such services is unavailable or insufficient, and where the commercial telecommunications market may be unable to deliver such basic services in a financially viable manner independently. Community public access through MPACs may include commercial centers (particularly locally owned), non-profit access points, or a PPP entity, depending of the appropriate model in the specific location and community. By ensuring the reasonable availability and affordability of both basic and advanced communications services, including voice telephony, internet access, as well as broadband connectivity, at the community level, the Fund will make a valuable

contribution to the social, educational and economic development of the country, particularly in rural areas where the current or planned infrastructure will not reach certain communities.

Community-based public shared broadband access makes sense from an economic as well as social perspective. It provides affordable access without expenses of ownership and it creates the community setting for needed training programs and support services, including many programs focused on the needs of women, girls, youth and the very poor in rural communities. The experience of public shared access has been documented extensively and illustrates the benefits of such approach to universal access. Successful experiences in South Africa, Mozambique and Uganda provide interesting lessons. Furthermore, recent research in Africa (e.g., Togo, Ghana, Kenya and the DRC) shows that telecenter-type projects in rural areas help keep youth in the region.⁶⁶

Recommendation: We recommend that the UA Fund provide a least cost subsidy for launch of about 4 MPACs per year in rural areas, after O3b service is launched in Liberia in 2012.

1.1.2 Collaborate with other sectors to develop critical infrastructure (electricity, roads) in rural areas of Liberia necessary to support telecommunications operations and affordable internet access.

Rural areas require not only telecommunications infrastructure but also reliable electrical and other infrastructure. It is possible for telecommunications operators to collaborate with electricity providers to jointly develop and install required infrastructure. The experience in Ecuador and El Salvador provide an example of where such partnerships are beneficial not only to the operators, but most importantly to the community they serve.

Recommendation: This recommendation reiterates this reports earlier focus on opportunities to co-build with other infrastructure providers such as electricity providers, in order to expedite rural development at efficient costs.

1.1.3 Provide Connectivity to Public Institutions in rural areas in order to implement GoL's eGovernment, eEducation and eHealth objectives.

Public service institutions, specifically schools and other education facilities, health facilities, local government facilities and other organizations serving public needs (such as social service agencies) in rural areas must obtain access to communications resources. All significant public institutions should be connected to both telephone and Internet services, ideally with broadband access in as many locations as possible in order for GoL's objectives regarding eGovernment, eEducation and eHealth to be achieved. All schools, including public training/educational centers, at every level should have Internet connections. All hospitals and health clinics should have both Internet and other data network connections as part of "e-health" programs. These activities need to be planned with input by and coordinated with existing programs to ensure that they complement each other and do not replicate efforts.

For example, the Ministry of Health in Liberia is already taking critical steps and making plans to benefit from ICT to improve its management systems. These efforts should be coordinated within the ICT Steering Committee to ensure that both the Ministry and the Fund collaborate to increase access to health institutions and to ensure that their current plans can be successfully implemented.

Recommendation: We recommend that the Ministry of Education coordinate any ICT projects in rural areas with the UA Fund, so that UA Fund projects can contribute to the success of school projects, by ensuring access to connectivity and ideally special prices for school access.

⁶⁶ For reference see, forthcoming report by the GenARDIS program.
<http://genardis.apcwomen.org/en/frontpage>

1.1.4 Provide Educational Opportunities in ICT through a Rural Education and Capacity Building Program.

Capacity building for potential users not only ensures that they will fully benefit from access, but also supports ongoing demand for services provided by the operators and universal access projects. While some of the training initiatives may be common to several universal access projects within Liberia, many others may be customized to specific ICT needs of different users. Capacity building initiatives may be developed in partnership with other institutions (e.g., Ministry of Health, Ministry of Education, Ministry of Agriculture, Chambers of Commerce, Local business cooperatives) to ensure that they are designed to meet the needs of users in each sector. The capacity building program should develop projects both for basic ICT training for *ALL* users (including, for example, targeted training for illiterate users of ICTs or for women farmers) as well as institutional users (i.e., those working in public institutions and in need of training in the strategic use of ICTs). ICT training and education programs may be developed in coordination with existing education programs, including adult literacy programs in rural areas (possibly managed by the Ministry of Education or Agriculture), or in coordination and with the support of private sector.

The experience of Uganda with the support by the Fund for school ICT laboratories is a good reference and provides useful lessons to Liberia (see Uganda case study in Global Best Practices).

Recommendation: We recommend that the UA Fund conduct a brief ICT needs assessment with public institutions and the public in general to inform the development of an Education and Capacity Building Program for Liberia. Once needs are clear and priorities are established, the Fund can support training and capacity building activities where MPACs are implemented and in other strategic locations in coordination with existing educational and training institutions.

1.1.5 Support the Development of Content and Applications through a Content and Applications Program.

In addition to voice communication, it is important to facilitate access to information via the internet. However, such information needs to be relevant to rural populations and provided in a format that is clear and understandable, including in the required languages. Local and meaningful content is critical to ensure demand for and a market for ICT services and applications. It can serve as an opportunity to build local capacity and/or support local businesses interested in content development for their communities, and delivered via ICT networks, including radio.

The experience of Uganda, South Africa, Dominican Republic and Mongolia inform this effort, and show that pilot projects are a catalyst for further development in the content and applications development area.

Recommendation: We recommend that the Fund support the development of local content and applications for at least half of the localities where MPACs and other UA projects are implemented.

1.1.6 Promote and facilitate the establishment of Public-Private Partnerships in the implementation of rural projects.

We recommend that much of the rural infrastructure, particularly outside rural county capitals, be funded by way of Public Private Partnerships and/or a Liberian USO Fund. As noted, PPPs provide a useful business model both for financing purposes as well as implementation and operational support. These partnerships may include local or national businesses, including those providing technical support, rural cooperatives, including women's cooperatives, as well as other local businesses with the ability to reach out to users.

Experience in Mozambique, South Africa and in several countries in Latin America (e.g., Peru, Colombia, Brasil) show that when there is a PPP from the outset, projects are more likely to succeed and may reach an operationally sustainable level at an earlier stage. In addition, PPP that focus on local/rural businesses provide operators with stronger links to the rural communities that they normally do not know. This is

critical both from a project management perspective as well as from a technical perspective, as it is critical for operators to have reliable local teams to address any needs of the networks, centers and projects.

Recommendation: We recommend that the Fund develop and/or sponsor PPP workshops to introduce stakeholders to the concept, to potential partners, and to the UAF as a way to promote PPP in the efforts towards universal access.

1.1.7 Develop a program to identify ICT Champions with the responsibility of increasing awareness and promote the use of ICT in the development of Liberia.

ICT and infrastructure projects have become quite visible in governmental development efforts and provide a great opportunity for awareness raising and promotion of the sector and its developments. This program should identify 2-3 national ICT Champions to participate in awareness raising and ICT sector promotion activities. Champions should be women and men involved in ICT projects and may be Government representatives, representatives of Operators, community development leaders, Teachers or school projects leaders, Farmers representatives, among others. Champions can be selected every other year with input from all sector stakeholders and the public in general. They should be responsible to attend specific events focusing on raising awareness of ICT for development and for sharing their knowledge with colleagues and/or others involved in ICT for development projects and initiatives.

Recommendation: We recommend that the Fund identify 2-3 national ICT Champions per year to participate in awareness raising and ICT sector promotion activities, such as seminars, working lunches and public discussions on issues of interest to the sector.

1.2 Policy: Cross-cutting Themes and Complementary Objectives

In addition to the above objectives, it is critical to consider certain cross-cutting themes and objectives that will ensure true universal access in Liberia.

Gender equality. It is critical to integrate gender equality in universal access goals and strategies to ensure that the benefits of the information society are equally enjoyed by women and men, and contribute to eliminate discrimination against women.

The rights of disadvantaged or physically challenged people. It is critical to integrate the rights of disadvantaged or physically challenged people in all activities to facilitate the use of communications services by individuals with special needs, through the use of specialised equipment, software, protocols and infrastructure.

Open Access. Programs and projects shall support and promote open access to content and information, open access to infrastructure, access to free and open software, and open access to the planning processes. This term was used in relation to the EASSy submarine cable and is one of the objectives of the ACE cable consortium, and requires members of the consortium to permit access to the cable and to capacity on the cable on reasonable, transparent and non-discriminatory terms, and further requires that the regulatory authority of the member concerned should take steps to enforce this.

1.3 Complementary Objectives

Although the underlying development goals are clear from the objectives above, it is critical to reiterate the complementary objectives resulting from this strategy.

- **Ensure that educational institutions and initiatives are appropriately equipped to strategically use the potentials of ICT in their programs and projects,** from basic ICT training to advocacy with ICTs, to the development of business opportunities.

- **Ensure that health care institutions and initiatives have the necessary ICT capacity** to provide quality and timely health care to all people in Liberia.
- **Ensure that public access points partner with local and regional organizations and institutions** providing services and support to the communities they serve.
- **Ensure that all projects and initiatives include a capacity building component customized to the needs and realities of the communities they serve.** It is important to make ICT meet the needs of the community, rather than simply create a market for ICT. For example, if a project is located in a farming community with high illiteracy rates, a capacity building program needs to consider the educational constraints and at the same time be designed to meet the needs of local farmers (i.e., provide the type of information they need in a format they can understand, which may be through spoken media, video, photography, among other options).
- **To make a lasting contribution in the development of local content and applications necessary to support development in the communities served.** This requires a strong commitment to local development and an understanding of the importance of information and content to currently unserved communities.

1.4 Key Principles

In addition to principles specified in the existing regulatory and legal instruments, a number of key principles provide guidance in the development and implementation of this rural connectivity and development strategy in Liberia.

Sustainability. Support and promote the establishment of efficient, self-sustaining, market oriented businesses, which will continue to expand access to ICT on their own initiative. In some cases, non-commercial yet sustainable initiatives and projects may be the appropriate model. These should be supported either through the universal service and access fund or other available resources.

Local and community ownership. Rural development depends greatly on the ownership and commitment by rural businesses and communities. Support the expansion and development of local and community based and owned projects, as critical elements to economic and social development.

Sequencing of steps. It is critical for the success of a rural development strategy that it follows a specific sequence of steps in the implementation of its components. Failure to comply with the proposed sequence will most likely compromise the implementation and success of the strategy (as many necessary factors may not be in place to ensure success).

1.5 Collaboration (Inter-ministerial Project Coordination)

It is critical for the success of a rural connectivity framework that on-going collaboration with stakeholders takes place at all levels of the planning and implementation processes. Collaboration should take place between all stakeholders involved in the sector, including sector operators and agencies, as well as agencies and stakeholders dealing with a wide range of infrastructure, services, and information content, such as Education, Health Care, Agriculture, and national and local administrations involved with E-Government planning and service provision, including the ICT Steering Committee.

The Ministry of Posts and Telecommunications should convene a coordinating committee or actively participate in the existing ICT4D Steering Committee to ensure that it brings together diverse interests into its planning activities, which should be informed by and developed in parallel across multiple sub-sectors. Resources should be linked wherever possible, so that investments in infrastructure, equipment, and human resource development can produce the maximum impact for the least cost.

1.6 Some Options for Demand Stimulation in Urban and Rural Areas

In order to encourage private sector construction of rural infrastructure for communications access, particularly the internet, the GoL must encourage the development of demand for internet in order to provide a profitable market for operators. Commercial operators will only build infrastructure if they believe sufficient demand will exist to permit them to earn a profit or if they are provided subsidized financing to off-set the extra-cost associated with building infrastructure in “high-cost” areas.

Demand stimulation in urban and rural areas in Liberia may occur in several ways. The following provides a brief overview of some options that should be considered and can contribute to greater demand for ICT services and products. Some of these overlap with the strategic objectives and may be implemented in coordination. Other require specific and additional efforts from the Fund agency, the LTA, the Ministry of Communications and the ICT Steering Committee.

- **Promote and support the development of broadband infrastructure and service options to rural areas of Liberia, both in county capitals and beyond.** With launch of ACE service in 2012 and as overall investment in rural areas increases, service options will also increase. The LTA should consider regional licenses to promote rural access at affordable prices. Rural enterprises are more likely to understand the rural market better and be more interested in expanding their business options in those areas. This approach has been successful in countries in Latin America, such as Peru and Bolivia, where rural farming communities and rural enterprises were interested in establishing rural operators or expanding existing businesses into telecommunications services.
- **Promote and support the development of local content in local Liberian languages.** Although substantial content in English language is available, many Liberians only speak their local dialect, particularly in rural areas. In order to encourage internet relevance and demand for ICT services and applications, particularly in rural areas, local and meaningful content must be developed and made available. It can serve as an opportunity to build local capacity and/or support local businesses willing to develop content for their communities, and delivered via ICT networks, including radio. Such content could include updates on market prices for local produce such as fish and agricultural products; weather forecasts, emergency information, land registration information, among others.
- **Support adult literacy programs in rural and urban areas of Liberia.** GoL’s ICT policy and institutions should promote and support the ongoing efforts to educate the population, not only to increase general literacy levels but also to use these settings as environments to learn and become comfortable with ICT tools and applications.
- **Engage in a national educational campaign in Liberia to increase ICT skills among the population.** The GoL and private telecom institutions should partner to develop and implement a national ICT training program to provide ICT training at the national level to all interested. Such training should include such items as basic communications skills to using the internet to market a business.
- **Practice affordable service prices, including those for handsets, to facilitate adoption of ICT services by Liberians.** Operators and regulators should work together with the GoL to ensure that service tariffs and handsets are affordable to the population, both by ensuring that tariffs are based on the cost of providing the service and that handsets prices are not unreasonably priced due to high import tariffs.

1.7 From Objectives to Programs, Targets and Projects

The action plan in Appendix 1 takes the proposed strategy and provides a practical guide on how to implement this strategy. For each objective identified under the strategy, a program is developed and specific projects are developed to meet the goals of the program. These take into account the several cross-cutting themes and principles established for under this strategy. This action plan reflects a phased approach to project implementation, to ensure that projects are linked and benefit from the overall strategy.

APPENDIX 8: GLOBAL BEST PRACTICES IN UNIVERSAL ACCESS: LEARNING FROM EXPERIENCE

Universal Service/Access policies and Funds have become an increasingly important feature of national telecommunications and ICT development policies around the world in recent years. Many different countries, in Africa and elsewhere, have introduced US/UA Fund mechanisms to support rural network and service delivery, with mixed results to date. Many of these programs have now been in place for several years, creating a growing body of experience and lessons that can be considered in developing new ideas and plans for Liberia.

In particular, several recent studies and reports have highlighted international experiences and practices with US/UA policies and Funds, and provide key findings and recommendations for the next wave of policies in this area in the developing world. These reports include an extensive study by Regulatel and the World Bank of the experience in Latin America, the ITU/InfoDev ICT Regulation Toolkit module on Universal Access, and the recent ITU report on universal service funds in Sub-Saharan Africa.⁶⁷

We note that the distribution of broadband through ACE in Liberia should be one component of a comprehensive universal access strategy, which includes other elements such as those discussed in this document as well as in the proposed strategy outlined in this report. The following discussion provides summary lessons and principles arising from international reports as well as other recent country experience with innovative and effective approaches to Universal Service/Access.

1. UA/US STRATEGY, OBJECTIVES, POLICIES, AND REGULATION

The most important stage of Universal Access/Service policy development is at the highest levels of strategic planning and coordination with other national ICT policies and regulation. The decisions made at this level will critically determine the framework and scope of opportunities for detailed UA/US policy to succeed. The table below highlights some of the most prominent Best Practice principles and recommendations for establishing broad policies, strategies, and regulatory objectives.

⁶⁷ The World Bank/Regulatel Study, *New Models for Universal Access in Latin America* (<http://www.regulatel.org/miembros/publicaciones/ESTU%20DIOS/SERV%20UNIV/PPIAF/informe%20final/draft%20vf/Ab%20%20Summary%20v%209.pdf>); The ITU/infoDev *ICT Regulation Toolkit* module on Universal Access and Service (<http://www.ictregulationtoolkit.org/en/Section.3126.html>); The IDRC's book on *Telecentres, Access, and Development*, which includes chapters on the experiences of both Africa and Uganda and South Africa (http://www.idrc.ca/en/ev-87255-201-1-DO_TOPIC.html); The recent ITU Report on *Universal Service Funds in Sub-Saharan Africa* (<http://www.itu.int/ITU-D/afr/events/FTRA/2009/DownloadSection.html>).

UA/US STRATEGY, OBJECTIVES, POLICIES, AND REGULATION

1.1 High Level Planning and Coordination

ICT development and access policies should be coordinated at the highest levels of public sector planning and policy with other key stakeholders and strategic efforts. Some of the essential features of such a coordinated strategy should include:

- *Multi-sector participation; leadership:* The key objectives and priorities for Universal ICT Access should be determined not only within the traditional telecommunications sector, but among agencies and stakeholders dealing with a wide range of infrastructure, services, and information content.
- *Coordination of policies and initiatives:* Just as leadership and planning should be coordinated, practical policies and initiatives should also be developed in parallel across multiple sub-sectors.
- *Demand aggregation:* Public agencies that can benefit from internal and external ICT networks, services, and applications are among the most lucrative customers for such services, particularly in less developed areas. By strategically combining the procurement of such agencies for these types of ICT resources, Governments can ensure local, competitive providers of a reasonable and consistent revenue stream, enhancing the financial prospects of UA/US projects.

Key Lessons for Liberia:

As in many countries, Liberia has multiple agencies involved at some level with ICT deployment and utilization to promote public objectives, and has already taken important steps to establish national-level ICT policies on a coordinated basis. The policies and practices of the LTA with respect to Universal Access, particularly the uses of funds, via a universal access/service fund, should be linked closely to these other programs.

1.2 Regulatory Policies to Support UA/US Objectives:

The role of telecommunications/ICT regulation in supporting Universal Access/Service goals is also critically important. Ideally, the competitive market should have the first and most open opportunity to expand networks and services to underserved areas, and flexible, facilitating regulatory approaches can help encourage private sector investments without subsidies. Where US/UA Fund approaches are involved, the regulatory role is also vital to ensure that projects are sustainable and equitable, and have the greatest chance of success. The following are among the most important regulatory recommendations to support UA/US objectives:

- *Spectrum:* Review spectrum use policies related to license-free spectrum especially for rural applications to facilitate the deployment of technologies that use these frequencies for universal access projects.
- *Voice-Over-IP:* Remove burdensome restrictions or prohibitions on VoIP-based networks and applications and instead encourage their deployment and use as a cost-effective means to expand affordable access especially for rural and un-served area applications.
- *Licensing:* Implement a simple, pro-competitive licensing regime which encourages and facilitates the establishment of smaller, independent telephone operations in rural communities and underserved areas, especially where incumbent operators may have chosen not to build networks and provide services
- *Interconnection:* Implement and enforce regulations to ensure rapid establishment of interconnection agreements for newly established rural networks, including setting maximum permissible delays.

- *Quality of Service:* Introduce greater flexibility in quality of service and other standards pertaining to networks and services in rural and underserved areas where this will either not cause any harm to the network or where the impacts are minimal, if stricter standards are an impediment to investment and development of rural networks and services.
- *Infrastructure and Facility Sharing:* Introduce regulations that promote and facilitate infrastructure and facilities sharing, including the use of rights-of-way among telecommunications operators and also with other public service operators (electricity transmission and distribution, pipeline companies, public works ministries, railways, etc.).
- *Pricing:* Review wholesale prices for high capacity leased lines, Internet connectivity, and other essential services, especially in remote areas, to ensure that they are cost-oriented and affordable in the context of Universal Service goals.
- *Asymmetrical regulation:* In some respects, it may be appropriate to apply “asymmetrical” regulation to projects and services delivered in designated underserved, Universal Service areas.

Key Lessons for Liberia:

As the LTA works towards establishing a comprehensive regulatory framework, it should consider the above areas, particularly in the specific context of rules and policies that apply to Universal Access locations and projects.

1.3 Technical Capacity Building Requirements:

- Human resource capacity is an overriding pre-requisite for successful design and implementation of every ICT development program or universal access policy, as well as the underpinning of market growth as a whole. In these areas, coordination of training and capacity building efforts can be highly cost-effective
- It is also important to undertake practical capacity-building within the USF administrator itself, to support the effective implementation of policy. Such programs should be based on learning-by-doing, including identification, design, tendering, and awarding of projects. The initial focus of such activities could be on targeted pilot projects involving limited geographic areas, rather than large-scale national deployments.

Key Lessons for Liberia:

The findings and recommendations above concerning the role of capacity building in UA/US programs represent important principles that LTA must also take into account from the outset of its new policy and strategic planning. Capacity building initiatives should be incorporated within every Universal Access project, and LTA’s staff involved with the Fund will require extensive and ongoing capacity building and training support.

2. US/UA FUND MANAGEMENT, ADMINISTRATION, DISBURSEMENT

After policy, strategy, and regulatory considerations, the success of a US/UA Fund depends upon establishing an effective management structure, administrative procedures, and disbursement criteria, which can be implemented in a transparent and timely manner. Many USFs have had difficulty moving beyond the mere collection of money, or the funding of small pilot projects, into full-fledged allocation and disbursement of funds across wide areas and multiple projects. This is often because of political, technical, and personnel capacity issues that have not been adequately resolved from the outset. The experiences of successful funds – and of less successful ones – provide important lessons in how to maximize the effective use of this important resource. The table below provides recommendations from a recent study of UA Funds in Africa.

2.1 Recommendations of the ITU Sub-Saharan Africa USF Report

This recent report examined US/UA Fund experiences in more than a dozen African countries, including both operational and non-operational Funds, and drew key lessons and findings from the various approaches and outcomes of those countries. The key recommendations of this report on the core issues of Fund management, administration, and disbursement include:

- *The USF should operate based on a Strategic Plan:* USF planning, project development, budget allocations, and all other decisions should be based upon a medium- to long-term Strategic Plan, which takes into account overall objectives, industry conditions, financing, and the Fund Administrator's capacity to implement its goals. Where Funds only develop short-term, *ad hoc* plans, they have less impact.
- *The USF should be established as a distinct Administrative entity, governed by a Board with a group of dedicated staff:* The responsibilities and functions of the USF Administration are complex and require considerable skill and time. The decisions to allocate funding are also politically sensitive. These factors underscore the need for a separate and distinct entity to administer the Fund, with a transparent and neutral Board.
- *The USF disbursement function should be outsourced to professional third-party commercial entities:* Control of the flow of funds is a sensitive as well as technical task, and one of the most likely areas where problems, mismanagement, and other difficulties can arise. Where the capacity is not sufficient internally, the accounting and financial management functions, particularly payment disbursements, should be separately and professionally contracted.
- *Establish review and sunset provisions on USFs:* The conditions that exist when a Fund is established may change over time, so it is important to review their performance every 4-5 years, and to update their mandate as appropriate. Also, where many Funds have had difficulty fully spending their income, it may be necessary to consider a moratorium on collections. In some cases, a Fund may ultimately be disbanded if necessary, with any surplus moneys returned to the operators in proportion to which they paid, and/or transferred to the Government.

Key Lessons for Liberia:

Each of the specific recommendations listed above based on international best practice experience has useful implications for LTA and the planned universal service/access fund, as the new UA/US strategy is put in place and evolves over time. Not all recommendations may be relevant from the beginning, as some may become more important once the Fund has been operational for some time. But the recommendation for a strategic plan is appropriate, as this present report represents the foundation of such an approach.

3. PROJECT PLANNING, DESIGN, IMPLEMENTATION

Projects that are implemented utilizing Universal Service Funding or other public resources to promote ICT development bear a special responsibility to be carefully planned and designed, and implemented with attention to effective and sustainable operations. Among the many projects that have been established in recent years in this field, there are numerous examples of failed or inadequate outcomes, which can be largely attributed to poor planning from the outset. In reviewing the lessons of such projects from around the world, a number of key principles have emerged, which should be taken into account.

3.1 ICT Regulation Toolkit for UA/US Policies

The ICT Regulatory Toolkit highlights the following principles:

- *Commercial sector-led & market-oriented implementation:* The UASF is an instrument to collect and distribute funds to the sector for rural network and service development, using a competitive, transparent and fair mechanism. The UASF is to develop market-oriented programs and subsidize projects that will be primarily implemented by private sector operators and service providers.
- *Service and technology neutral:* The UASF mechanisms must enable any service provider (e.g., fixed or mobile and Internet service provider) to compete for subsidies, and to use the most effective, efficient and appropriate technologies, deployed most cost-effectively to be implemented for universal access and service.
- *Smart subsidy, commercial viability & sustainability:* The subsidy approach should be based on the principle of smart subsidy or output-based assistance (OBA). This is an initial subsidy that is designed to be result-oriented, does not distort the market, and encourages cost minimization and growth of the market. The smart subsidy approach is designed to allow operations to become commercially viable and not be dependent upon ongoing subsidies. Projects that are able to become sustainable are preferred over projects that require long-term additional financial support from the UASF.

Key Lessons for Liberia:

Universal Access Fund projects should, as often as possible, be commercially viable and sustainable, utilizing smart subsidies, and be technology-neutral. They should take into account the availability of existing infrastructure, backbone capacity, be clearly defined and open to a wide range of bidders.

4. CASE STUDIES OF DEVELOPMENT OF RURAL INTERNET USAGE

The following three case studies of Uganda, Mongolia and the Dominican Republic illustrate several of the best practices suggested above and provide good examples of how 3 countries went about implementing a universal access strategy that was well planned, had support from all key players and focused on pilot projects as the initial step towards full universal access support.

5. CASE STUDY: UGANDA

Uganda has earned a reputation in recent years for its successful development of a Universal Service policy, among the most prominent and well-functioning in Africa.

5.1 Background

The UCC issued the RCDF policy in 2001, and formally launched the Fund in 2003, with a clear and detailed strategy document at its foundation. The Uganda Government also established a national ICT policy in 2002, which linked together the goals and efforts of different agencies and initiatives for ICT development, including establishing a national coordinating body. The RCDF policy includes a wide range of medium and long-term objectives for Universal Access in Uganda. The Fund collects 1% of licensed operator revenues for use toward these goals.

5.2 Telecentres

Some of the earliest and most prominent projects undertaken through the combined resources of UCC, RCDF, and other stakeholders involved the establishment of local public telecentres in key rural communities, including several School-based telecentres (SBTs). These were relatively small pilot projects, designed to understand the market for and local response to such services in a few selected areas

5.3 Wireless Broadband

Another key initiative undertaken by the RCDF was to support the establishment of broadband wireless access to ICTs in rural Uganda. The Fund developed a project to install wireless broadband (WiMax) transmission Points of Presence at every district level, allowing local users, from schools to administrations to private households and businesses, to obtain Internet access through a wireless receiver. The Fund also supported a project to establish local Internet cafés and institutional connectivity in each district served by this system. Both projects were tendered on a competitive basis by the RCDF. For a combined subsidy of about US\$1-million, some 32 district centers were provided with wireless broadband access

5.4 Other Achievements

The UCC and RCDF have devoted funds and efforts to a range of other UA/US initiatives in recent years, in line with their overall mandate and strategic plan. According to the UCC official web site, the Fund has made great strides toward numerous of these goals. These include:

Table 3. Uganda RCDF: UA/US Initiatives

Program Area	Commissioned Projects	Projects Under Development
Internet Points of Presence	70	6
Internet Cafe	55	45
ICT Training Centres	70	2
Web Portal	78	0
Public Pay Phones	2249	350
Research Projects	4	0
Postal Support Projects	15	20
Multi-purpose Community Telecentres	13	11
School ICT Laboratories	35	60
Health Care ICT Facilities	20	23
Call Centers	0	1

Sources: IDRC, ITU-InfoDev ICT ToolKit, UCC.

6. CASE STUDY: MONGOLIA

Excerpt from **Output-Based Aid in Mongolia, Expanding telecommunications services to rural areas**, OBA Approaches, February 2008.

When Mongolia conceived its universal access program in 2004, public telecommunications service in most rural areas was inadequate and unreliable. Service was available only at Mongolia Telecom offices in the soum centers and only during business hours. Until recently there was no service at all outside the soum centers.

6.1 Setting Targets

The universal access program set specific targets, such as having at least one mobile or wireless operator in each soum center, offering broadband wireless Internet service in some soum centers, and, having at least public access telephone service in the country's 1,500 remote herder communities, or baghs. To finance network expansion into rural areas, the country's Communications Law of 2001 had called for a universal service obligation fund. Later legislation stipulated that operators will contribute to the fund through a 2 percent levy on their taxable income starting in 2007. This fund was set up with the assistance of the World Bank through grants from the Public-Private Infrastructure Advisory Facility (PPIAF) and the Global Partnership on Output-Based Aid (GPOBA). The World Bank also provided seed financing of \$5.5 million for the initial universal access subsidy projects.

6.2 Designing Pilots

Two pilot projects, supported by a \$259,400 GPOBA grant, were designed as the first steps in rolling out the universal access program:

- *Herder public access telephone network*—to provide public access telephones for herder communities in 27 baghs, spread among 6 soums in 2 provinces (*aimags*).
- *Soum center wireless network*—to provide wireless voice and data services to one soum center in Tariat soum in Arkhangai, which had previously had only limited service. Besides providing mobile voice and Internet services to the public, including a commercial cybercafe, the operator's responsibilities include providing subsidized Internet access to the school for three years, with a declining subsidy.

6.3 Key Success Factors

The pilots are considered to be a success: the bidding competitions resulted in fully compliant bids below the estimated maximum subsidies. The pilots have provided important knowledge about rural demand for better communications services and allowed the testing of technical and commercial solutions that can be adapted to local conditions, including a nomadic population.

Several aspects of the Mongolian experience have led to this success—and also promise success for the entire universal access program:

- The Communications Regulatory Commission has been strongly committed to the program.
- Skills transfer and national program ownership were at good levels at the critical times.
- Tenders were prepared in consultation with operators and stakeholders.
- Strong competition in the sector—together with the traditional importance of the countryside and the project's least-subsidy design—has been a key factor in overcoming the higher marginal cost of providing access and connections in remote areas.
- The GPOBA subsidy enabled the program to be piloted before the operators started to contribute to the universal service obligation fund. That helped demonstrate the fund's benefits for the operators, increasing its acceptance.

7. CASE STUDY: DOMINICAN REPUBLIC

In 2007, the government of the Dominican Republic and the telecommunications regulator, INDOTEL, initiated an ambitious project to provide broadband access to 508 mostly rural communities in the country. As part of the *e-Dominicana strategy*, the **Rural Broadband Connectivity Project** has as its objective to bring residential, public telephones and broadband services to 508 localities throughout the country that had no residential telephone connections or broadband Internet access. Broadband services were also to be made available through Internet cafés and telephony through public call centres.

One of INDOTEL's primary efforts in promoting broadband and the use of computers has been directed towards the installation of local community Informatics Training Centres (CCIs) and supplying them with computers since 2004. INDOTEL has funded the cost of these CCIs and other universal access and universal service projects with resources from the Universal Service Fund. By May 2007 more than 400 CCIs had been established across the whole country but due to the lack of telecommunications infrastructure only a few had access to broadband. Following market and field studies, the winning bidder for the broadband project, Claro-Codetel, decided to deploy ADSL where there were fixed lines and 3G (UMTS) wireless access where there was no existing fixed-line infrastructure. A pilot project was implemented to assess the feasibility of the overall project. By the end of January 2009, 108 of the 508 localities had been connected and it was planned to have all 508 connected by the end of September 2009.

The experience led to a number of conclusions and best practices:

- There should be no barriers to the implementation of rural broadband connectivity projects when national policy supports such projects and when the regulator is committed to promoting them and providing its resources and facilities to demonstrate their viability and help in their realization.
- It is important for the regulator to share its vision of rural broadband projects with telecommunications operators and service providers in the country. The industry must be kept informed continuously and involved in the development of the policies for rural broadband projects and the plans for implementing projects to achieve the objectives of these policies.
- Offering available spectrum as part of the tender can serve as a useful incentive to get operators to participate in the process for awarding rural broadband licences. This has the added benefit of reducing the amount of subsidy that is requested in the minimum subsidy tenders.
- Rural areas are full of young people who are anxious to embrace the arrival of broadband and all the services that broadband can deliver.
- Given the particularities of the telecommunications sector, official public approval processes should treat projects in this sector differently from other public infrastructure projects in order to avoid unnecessary delays in implementation.

E-Dominicana is a national strategy which has as its mission "to promote the use and appropriation of Information and Communications Technologies in the Dominican Republic by means of initiatives that create synergies between the governmental sector, the civil society, and the productive sector, to offer all its inhabitants better opportunities which will contribute to their development, by bringing them welfare and progress in the exercising of their capacities

Adapted from: **BRINGING BROADBAND ACCESS TO RURAL AREAS: A STEP-BY-STEP APPROACH FOR REGULATORS, POLICY MAKERS AND UNIVERSAL ACCESS PROGRAM ADMINISTRATORS.**

THE EXPERIENCE OF THE DOMINICAN REPUBLIC, prepared by Edwin San Roman, Senior Regulatory Expert, Indotel, Dominican Republic, for the 9th Global Symposium for Regulators (GSR), to be held in Beirut, Lebanon, 10-12 November 2009

APPENDIX 9: REPORT: RAPID ASSESSMENT OF ACE CABLE CONSORTIUM PARTICIPATION

This Appendix incorporates the body of the IBI Rapid Assessment Report submitted to GoL on March 24, 2010. The appendices of that report are not included in this appendix.

1. CURRENT STATUS OF ACE AND LIBERIAN PARTICIPATION

The Africa Coast to Europe (ACE) submarine cable system extends 14,000 km from Penmarch in France to Cape Town in South Africa. As shown on the map included in section 2 below, the system is configured into 5 segments with 24 possible landing stations.



Figure 64. ACE Cable System

1.1 Cost of ACE Membership and Liberia Landing Point

It is important that all stakeholders understand that the cost of ACE membership and attendant obligations is substantially more than \$25 million, as the following paragraphs illustrate.

Liberia has been admitted as full consortium partner in the construction of a fibre link to the Cote d'Ivoire-Guinea component of the cable. Libtelco has already confirmed Liberia's commitment to participate in this cable system by signing an Additional Party Memorandum of Understanding (which supplements the main Memorandum of Understanding signed by the other members) (ACE MOU) and making a \$40,000 payment to ACE made in early 2010, to cover "pre C&MA costs" of the negotiation and preparation of the MOU. The window for participation will soon close as the cable is scheduled for construction to meet a late 2012 commercial in-service. Construction is expected to commence immediately after the appointment of a manufacturer.

In order to secure full membership in ACE, the Liberian consortium must agree to:

- Pay up to \$25 million in a series of payments as called upon to do so by the IMC (interim management committee of ACE);
- Estimate and pay for the costs of construction of the Liberian landing station and the cost of the additional cable and equipment required to connect to the landing station along with an "appropriate share" of the trunk cost;⁶⁸
- Provide a guarantee to ACE to cover over-runs and the minimum investment amount to secure capacity on the cable as a landing member;
- Fund ongoing operational and maintenance costs to be determined by the relevant ACE committees from time to time under clauses 18 to 22 of the ACE MOU, and as notified to the parties every 2 months.

Other "internal" costs will need to be funded by Liberia as landing member, including:

- the cost of land acquisition for the landing point, unless GoL is minded to make land available;
- construction of premises to house staff and equipment;
- the acquisition of a licence from LTA under the Telecommunications Act, 2007; and
- the acquisition and installation of network equipment required to operate the landing point and connect to backhaul and related network facilities. Associated staffing costs, day to day running expenses, monitoring equipment and switching facilities will no doubt also need to be budgeted for.

In addition, if IFI funding is onlent by GoL to the Operator Consortium or some other Special Purpose Vehicle used for ACE, the following additional costs will be incurred (among others) in order to meet the funding conditions of the IFIs (though presumably these costs would be funded by the IFIs themselves):

- Environmental review;
- Resettlement of indigenous people affected by the landing point and associated facilities being installed; and
- Social impact studies.

⁶⁸ Memorandum of Understanding for the planning of ACE.

1.2 Next steps for ACE Membership

The members of ACE will meet in Paris on March 27, 2010 where each country consortium will present its plan for structuring and financing its participation in ACE. Although a business plan is not required at that meeting, the Consultants understand that the Liberian party must convince ACE IMC that it can fully fund all ACE payment and construction obligations. In addition, the Construction and Management Agreement (CMA) will be further discussed so that it can be signed on April 27, 2010. Based on the current timetable included in the draft CMA provided to us (which may not be the most recent as it does not include reference to Liberia as member⁶⁹), within 45 days thereafter, Liberia must forward 20% of the \$25 million estimated cost for ACE to the Central Billing Party established by the IMC.

2. TECHNICAL ASSESSMENT OF ACE

The cable design is both “state of the art” and proven, and involves no significant technology risk. The choice of SDH electronics is conservative and has reasonable efficiencies carrying Internet Protocol (IP) traffic. The cable route is relatively well known and at least some initial marine survey work appears to have been undertaken. Construction of the system was tendered as an open international competitive bid. During bid evaluation, negotiations appear to have been undertaken with a shortlist of three bidders, and best and final offers requested from a shortlist of two. The estimated cost after best and final offers is consistent with similar cables built and planned in this region.

The system supply contractors, Alcatel-Lucent and Tyco who are poised to receive awards, are well established and both have decades of experience and have constructed several hundred thousand km of submarine cable. Alcatel-Lucent was the turnkey contractor for EASSy (2007-2009) and managed the SAT-3/WASC cable construction (entered service in 2002). Alcatel-Lucent is expected to be awarded segments S1 through S4 and Tyco segment S5. Given the technology, design and experience of the contractors, the implementation risk is minimal.

There is a risk of cable breaks on the operational system. Although good design, including the cable route, cable landing points and landing construction, can mitigate risk, the probability of a break at some time during the design life is non-zero. Backup capabilities will be required until a second route diverse landing is available. Initially this backup will be satellite and, as fiber connectivity is achieved with Ivory Coast, alternate cable routing via other cable connections that terminate in Abidjan will be available (SAT-3 now and WACS in 2011).

Further detailed and very important information is set out in Annexure 2 read with Appendix E.

3. OWNERSHIP OPTIONS REVIEWED IN THIS REPORT

As noted above, this Report assesses two potential ownership structures for membership of ACE and ownership and operation of the landing point in Liberia:

- Commercial consortium of Liberian operators (with voting rights based on initial investment) that will own participation in the cable (and steps have already been taken by Liberian operators in this regard); or
- Special purpose vehicle (SPV) structure which would initially include GoL as represented by Ministry of Finance, funded by one or more international financial institutions (IFI); the primary objective of this structure should be limited to a “bridge financing” role, such that GoL would

⁶⁹ The Consultants have not been asked to conduct a formal review of the CMA and at present, the document is not in a near-final form. Formal review will highlight the conditions and other risks that may be associated with signing and committing to the obligations (particularly in relation to funding) under the CMA. Consultants assume that each operator has appointed its own legal representatives and that the parties themselves are fully aware of their potential obligations.

participate as either sole member or together with Liberian operators (if one or more operators can arrange financing in time to invest), with the objective of GoL subsequently selling its interest in the consortium to Liberian operators as rapidly as possible.

Each option has advantages and disadvantages which we examine briefly below. The Consultants believe that it is important that LTA not be involved in the consortium or special purpose vehicle, given the extremely important role which LTA must play in establishing a stringent regulatory framework with respect to the operation of the landing point and access to capacity on the cable. Furthermore, the Consultants believe that GoL should not be involved as an equity owner of the consortium or SPV (though it may on-lend to the entity funds loaned to GoL by IFIs) in order to avoid conflicts of interest related to its ownership of Libtelco and role in setting policy.

3.1 The Liberian Operator-led Consortium Option

The Consultants are encouraged by the substantial progress that commercial operators have achieved over a very short period of time in establishing their own consortium to own, fund and operate a Monrovia landing point. We understand that operators have formed a group (the 6 existing mobile and fixed operators, including West Africa Telecom which recently launched service), liaised with LTA and GoL representatives, and have signed a memorandum of understanding (MOU).

In addition, substantial progress has been made in finalising a formal commercial consortium agreement between the consortium members Cellcom, Comium, Libercel, Libtelco, Lonestar and West Africa Telecom (WAT), known as the Cable Consortium of Liberia or “CCL”. The draft consortium agreement is called the CCL agreement in this Report. A company is being incorporated and discussions are underway with LTA to obtain a licence for the consortium, as required by the ACE MOU. If formed, CCL would be billed by ACE, and the members of CCL would need to allocate maintenance and operational responsibilities between them, possibly jointly owning and operating the cable landing station, backhaul and capacity for deployment within Liberia. It is very possible, however, that CCL may not be able to fully resolve the many structural issues that must be addressed prior to the March 27 deadline to present their commitment to IMC.

This Report also considers what Libtelco’s role might be in the consortium and how this might help position GoL interest. Libtelco’s lack of funds need not limit its participation if GoL on-lends funds provided to it by IFIs or if other contributions by Libtelco “in kind” are considered to have equal or similar value (in effect, securitization of the long term value of access by the consortium to Libtelco’s ducts or local loop).

As GoL and IFIs have expressed interest in participating in ACE through a public/private partnership, the Report also considers very briefly whether or not a public/private partnership arrangement (PPP) might be a useful vehicle for investment in ACE by both GoL and Liberian operators. A PPP is, in our view, possibly over-engineering the arrangement given the complex terms that usually apply to these sorts of contracts, and for a variety of other reasons that we have set out in more detail in Annexure 3.

3.2 GoL Participation Option

GoL is understandably concerned that Liberia’s broader national interests be protected and advanced if ACE is permitted to land in Liberia. To this end, GoL has expressed interest in itself becoming a member of ACE. We understand however that GoL’s direct membership in ACE is not permitted by the ACE CMA which require that members be accountable and liable for breach of their obligations and of course, governments typically have sovereign immunity. We understand that GoL has considered other alternatives including joining CCL, or involving participation by Libtelco in some form.

The Consultants understand that GoL has requested funding from an IFI for the full \$25 million cost of participation estimated thus far, and that a major IFI has responded positively on a preliminary basis to this request. If funding is provided for Liberia’s participation directly to GoL (presumably in the form of

sovereign loans to GoL to be applied to fund ACE membership either directly or onlent to the consortium), conditions are likely to be applied by the IFI which may affect the CCL and the participation by the Ministry of Finance, particularly if they relate to commercial or operational matters or revenue commitments. At this point, a full review of conditions cannot be undertaken as it is unclear whether IFI funding will be made available to GoL or on what basis it might be provided.

The Consultants recommend that any GoL option be used only as a “bridging mechanism” and only if operators are unable to finalize terms of the CCL in time to meet the March 27 and April 27 deadlines set by ACE. The GoL should only be involved if it can actually facilitate access to loans by IFIs which would be made available to the consortium. Typically IFIs prefer to lend on a sovereign basis, with a government guarantee, not to a private consortium, so if necessary the Ministry of Finance might act as trustee for the funds from GoL, on its behalf. A separate independent trustee might also be appropriate to receive the funds from the IFI, hold the membership rights and subsequently transfer the rights after longer term operator participation is obtained.

In our view, GoL should not directly own equity in CCL, except perhaps as required in a “trust” capacity and at a very early stage, to be sold within a few months to operators (and certainly well prior to launch of the cable service). In effect, GoL (with funding from IFIs) could provide the structure and funds to facilitate Liberia’s continued participation in ACE while operators finalize the CCL or their participation in a GoL structured public/private partnership. We have examined this in more detail in Annexure 3 below.

3.3 Relative Advantages and Disadvantages of the Two Structures

A summary of the relative advantages and disadvantages of the two ownership structures is included in *Appendix A*. The Consultants believe that a Liberian operator-led, operator-owned consortium should be the preferred option for a number of reasons, including:

- Potential for conflicts of interest if GoL had ownership interests in both Libtelco and the consortium (or PPP), and also continued its role as policy maker for the sector via the Ministry of Posts and Telecommunications;
- Given the critical role required of LTA in developing a regulatory framework that will ensure that Liberian consumers fully benefit from low access costs via ACE, it is important that LTA maintain a high degree of independence from the consortium and its members; this independence would be strained if GoL were an owner of equity in the consortium or played some other leading role in the consortium;
- It is important to achieve a “Liberian” solution to ownership, management and funding of the landing point – this would not be achieved if a foreign-controlled operator owned and managed the landing point. A consortium owned by all Liberian operators (and not by any one operator) would ensure (shared) control stays within Liberia;
- IFI and donor support for Liberia has been predicated upon encouraging private or commercial entities to play a larger role in the economy; to support GoL in leading a public private partnership would be a step backward;
- Funding from third party investors may be more difficult to obtain if GoL participated in a consortium that has essentially commercial interests, and operational duties;
- Sovereign debt of GoL would increase if GoL participated in or lent funds to the consortium; and

- Including all operators under the terms of the draft CCL agreement which the Consultants have reviewed would promote “open access”⁷⁰, fair competition, better services for consumers, and improved communications for Liberia - all goals to which GoL is committed; and
- To the extent that funding is provided to GoL by IFIs, conditions are likely to attach to this arrangement which may affect the operation of the consortium and the participation by the Ministry, particularly if they relate to commercial or operational matters or revenue commitments. Without funding there does not appear to be any compelling reason to include GoL in the consortium at this stage.

3.4 Operator Consortium Next Steps

The CCL agreement is currently attempting to regulate the relationship between the parties in anticipation of the final approval of admission of Liberia as a landing point party, at which time additional commitments must be made by the consortium members, but it does not deal with all the matters that are relevant. The CCL agreement should anticipate the next steps to be taken by the consortium so that it is clear, for example, that further agreements are to be concluded which will cover matters not presently addressed in the CCL agreement. These steps include:

- incorporating a company under Liberian law;
- entering into a shareholders’ agreement;
- subscribing for shares in the company;
- arranging and funding their participation in ACE;
- producing a business plan and budget for construction and determining how these will be funded;
- selecting a vendor for the equipment needed for the landing station;
- conducting any regulatory processes required by the relevant land and telecommunications Ministries; and
- applying for a licence to operate an international gateway from LTA.

3.5 Libtelco Funding “In Kind” Participation

As it is clearly important to Liberia and to Libtelco’s prospects of privatization that Libtelco have a real level of involvement in this project, we have also considered as a standalone issue, how Libtelco specifically might be able to fund its participation in the consortium.

Libtelco has limited sources of financing and an aggressive roll-out plan for its CDMA service, which will require substantial investment. However, Libtelco’s valuable rights of way (a scarce resource), premises and high sites, and certain parts of its fixed network might be considered to have value to the other operators – if not right now, then in due course when improvements are made. If it is possible to assign value in financial terms to these assets and scarce resources, then it may also be possible to recognize a contribution by Libtelco other than in cash in relation to its future funding obligations within the consortium (and company formed by CCL).

⁷⁰ This term was first coined by EASSy, a subsea cable connecting countries on the east coast of Africa, as a principle permitting equal terms of access to all members of the cable consortium, and non-discriminatory access to all other requesting parties.

We have not commented on this option in detail as the relevant accounting principles of recognizing “in kind” contributions are out of scope of the present report, but if this option is considered to be useful then we recommend it be pursued with the appropriate experts.

This proposition will not assist in meeting the initial upfront funding obligations to fund ACE, which must be made in cash. However, we have considered how GoL might assist in this regard in summary above, and this option is dealt with in more detail in Annexure 3.

4. REGULATORY LEADERSHIP BY LTA REQUIRED

Coupled with the urgency to connect is an urgency to ensure that all operators in Liberia and new entrants will be able to access the cable and/or fund their own participation in the entity that owns it.

The LTA has therefore been tasked with creating a viable access regime in addition to the interconnection and facilities-leasing regulations already in place, which will require LTA to review the market structure and cost to access the cable, and most likely to implement restrictions on the price that can be charged for wholesale or retail services, or even for both. First, however, CCL will need a licence to operate the landing station.

4.1 Licensing CCL

The draft CCL agreement currently requires that members of the consortium each hold their own international gateway licence (which echoes the requirement of clause 15 of the ACE MOU). Currently all the mobile operators and Libtelco have this form of authorisation, however there are some restrictions on the technology that may be used by operators in future, which may restrict their ability to individually own or operate the gateway⁷¹. Therefore, in order to ensure that CCL can construct, own and operate the cable landing station in Liberia, it will need authority in the form of a licence issued by LTA under the Telecommunications Act, 2007⁷² (the Act) which gives it rights to install, own and operate international facilities and to make services over the cable landing point available to requesting parties including members of CCL itself.

4.2 The Law and Policy

The draft policy framework for connecting Liberia to undersea fiber cable which is presently being finalized, is likely to include a statement to the effect that “the Ministry of Posts and Telecommunications supports the use of a variety of means to obtain international connectivity for Liberia. These means can include undersea fiber optic cable as well as terrestrial, satellite, microwave, and other technologies”. To the extent therefore that operators were restricted in their use of technology by their own licence conditions, the policy wording might ameliorate this position.

Once the policy has been published in final form, changes may be required to the Act to anticipate that an international cable landing point will be established in Liberia, and to endow LTA with powers and authority to regulate this as an “essential facility” and to impose appropriate controlling conditions on CCL’s operation of the landing point and the terms on which capacity is made available.

⁷¹ The draft Licensing Regulations anticipate that licensees may only offer those services or operate those networks as are specifically provided for in the license. It may be appropriate that, in order to support the trend to convergence and enable the achievement of GoL policy goals, this restriction in the regulation be removed.

⁷² Liberian Telecommunications Act, 2007, Article 15. Requirement to Hold License (1) No person shall: (a) provide a telecommunications service to the public for direct or indirect compensation; or (b) own or operate a telecommunications network used to provide a telecommunications service to the public for direct or indirect compensation.

Although not necessarily a policy issue, we believe it will be important for LTA to issue guidelines sooner rather than later, indicating what steps it may take to create a suitable regulatory framework for the cable and related capacity sales. These guidelines would then be followed by clear regulations.

4.3 SAT-3 and Other Cable Experience Supports Need for Tariff Regulation

The SAT-3 cable experience indicates that substantial price reductions for service to Liberians are unlikely to be achieved in the near term after ACE launch without firm regulation by LTA. Although wholesale prices for international connectivity declined after SAT-3 launch, the cable failed to substantially reduce retail prices for internet connectivity in most countries in Africa, even in larger advanced countries such as South Africa.⁷³ Initial results with SAT-3 showed that the limited elasticity of consumer demand allowed SAT-3 operators to initially maintain pricing only slightly below pricing using satellite. In fact, even after two other international fiber optic cables, the East African Marine System (TEAMS) and SEACOM launched service in East Africa in mid-2009, the cost of internet access still failed to decline as substantially as had been hoped.

This oligopolistic pricing concern will be particularly important in a small market such as Liberia where the increasing concentration of market share by Lonestar and Cellcom leaves the smaller mobile operators and ISPs in an increasingly vulnerable financial situation.⁷⁴

With the expected arrival of EASSy on the east coast of Africa in 2011, there is renewed hope for substantial reductions in prices towards global benchmarks in eastern Africa, though operators and other stakeholders dispute this expectation. For example, telecom operators interviewed recently in Kenya stated that “no price reduction would be effected soon” after EASSy completion.⁷⁵

4.4 Regulating the Cable Landing Point

In many African countries and particularly Liberia, the likelihood of landing another cable in the medium term is almost non-existent. In order to provide international connectivity and broadband services in Liberia at reasonable prices, there are no other alternatives at present, which situation means that CCL will be a monopoly. Therefore, access to the cable on reasonable terms must be facilitated by LTA and the cost of both retail and wholesale capacity must also be controlled by LTA. This can be done in two ways:

- By imposing conditions within the CCL licence that require that access be given to requesting parties on reasonable and non-discriminatory terms;
- By introducing price regulation which will require some analysis of cost information regarding the landing point, CCL’s own (additional) costs, and cost of service to consumers.

This regulation need not unnecessarily constrain the ability of the landing point to obtain financing directly, as the landing point would exhibit aspects of a stable regulated utility with regulated tariffs, which would not be unattractive to lenders. Liberian operators would still have an incentive to manage the landing point as inexpensively and efficiently as possible in order to maximize their returns in the context of fixed tariffs. Under firm LTA regulation, instead of operators simply selling access for as high a price as can be obtained, CCL and operators would be incentivised to maximize uptake or capacity sold by building local Liberian infrastructure to support broad expansion of the customer base and usage by wider sections of the internet consumer pyramid.

⁷³ Although this was in part because of monopoly participation in the cable by the South African incumbent, then state-owned.

⁷⁴ Liberia Connects Report, AED.

⁷⁵ Tuesday, March 9th, 2010 | Posted by ITNewsAfrica.com. “EASSy Unlikely to Affect Cost of Connectivity”.

In other words, LTA must establish a regulatory framework that eliminates any short-term incentive for operators to charge high prices for international connectivity and simultaneously encourages the operators to obtain their profits from the landing point by constructing and operating local infrastructure in Liberia that can be used to distribute low-cost internet access across the country. LTA's role must therefore include correcting any market pricing failure that occurs in the landing of capacity to Liberia and the on-selling of that capacity (whether wholesale or retail).

We have examined this issue in more detail in Annexure 6.

4.5 Review of Markets for International Capacity and Essential Facilities

LTA will need to review the competition framework outlined within the Act and determine the extent to which it can use that framework to:

- Determine a relevant market for international broadband services
- Determine the cable landing point to be an essential facility
- Define dominant operators as (i) having significant market power in the relevant market, and/or (ii) control of an essential facility
- Determine appropriate conditions to be imposed in the licences of dominant operators to control dominance and mandate access
- Introduce price regulation to limit the prices that may be charged by dominant operators for (i) access to the cable, and (ii) co-location and interconnection, and (iii) downstream services (wholesale and retail).

It is also possible that in addition to finding that CCL is dominant by virtue of its control of essential facilities, the members of CCL who currently are anticipated to have exclusive rights to capacity on the cable, may also be regarded as having significant market power in the market for international broadband capacity. As a result, any agreements concluded by them should not restrict or determine prices at which capacity may be sold which are greater than cost plus a reasonable margin, nor should these prices be predatory.

5. FINANCIAL OVERVIEW

Given the limited information on ACE and the landing point and the constrained time available to the Consultants to complete this preliminary report, the Consultants have provided a preliminary analysis of financial issues related to ACE, including the following:

- Preliminary net present value analysis supported by economic model of demand for internet access in Liberia;
- Financing sources for cables;
- Possible structures for operator financing of the operator consortium;
- Actual ability of Liberian operators to finance acquisition of consortium shares;
- Potential constraints on financing of ACE.

Our preliminary analysis focuses on financing implications with respect to the two structures set out in section 3 above and in Annexure 3. The Preliminary Financial Analysis contained in detail in Annexure 4 provides more detail on the above issues. We have also provided the excel spreadsheet of this model and encourage readers of this Report to use the model to apply their own assumptions regarding demand,

prices and costs in order to develop realistic scenarios for the cable landing point. We welcome comments and input on the model assumptions and structure as we finalize the model.

5.1 Demand and Revenue Model with Net Present Value and IRR

In order to evaluate the Net Present Value (NPV) and Internal Rate of Return (IRR) of the Monrovia ACE landing station on a preliminary basis, the Consultants constructed a simplified demand and revenue model for general internet and IP network traffic to international destinations, taking into account the costs associated with ACE and possible wholesale prices for international access. The Consultants then calculated a preliminary NPV and IRR for the project. Over a 15-year study period NPV were estimated using a range of discount rates, summarized in the following table.

PRELIMINARY FINANCIAL INDICATORS FOR ACE.	
Discount Rate	Net Present Value in \$ Million
10.0%	51
12.5%	34
15.0%	21
17.5%	12
20.0%	5

Figure 65. Preliminary Financial Indicators for ACE

We conclude on a preliminary basis that full membership in ACE, if accompanied by robust regulation by LTA to ensure competitive pricing releases demand, has potential to provide low cost international access to a broad range of Liberians. For example, assuming a discount rate of 15%, our preliminary financial calculations indicate that this investment would have a project NPV on the order of \$21 million over 15 years, breakeven payback should occur in year 10, and an IRR of about 22%. At this preliminary stage, the Consultants have not provided conclusions regarding the appropriate range of discount rates that should be applied to the project cash flows.

Although the results appear relatively robust to changes, the Consultants have not conducted a formal sensitivity analysis and this remains to be undertaken. The underlying assumptions require further study and validation or adjustment. This is future work that should be undertaken. However, the Consultants have conducted a limited sensitivity analysis by assessing the impact on project returns if project costs were 50% higher than \$25 million and a price range similar to prices provided in the forecast in the ACE investment spreadsheet. Annexure 4 provides detailed assumptions and conclusions resulting from our analysis.

5.2 Ability of Liberian Operators to Finance Acquisition of Shares

Given their substantial market shares and financing capacity, the Consultants assume that Lonestar and Cellcom will purchase substantially more of the total 10 investment units under the current CCL agreement terms than the four smaller operators, Libtelco, Comium, Libercel and West African Telecommunications (WAT). The proceeds of CCL's unit sales will be used to fund CCL's ACE commitments. Lonestar and Cellcom can similarly be expected to contract for substantially more capacity from CCL than the smaller operators. In this way, each operator within CCL will roughly finance its own capacity in that each operator will determine the financing component of the price for providing internet access to its subscribers. This situation favours Lonestar and to a lesser extent Cellcom over Libtelco, Comium, Libercel and WAT, as the latter four operators will be more likely to have a higher Weighted Average Cost of Capital (WACC) than Lonestar or Cellcom. In addition, if cost overruns occur on ACE, these latter four operators will be least able to cope with funding the overrun.

We must be cautious in drawing conclusions regarding financing costs for the operators however. For example, although a recent calculation of the WACC of MTN Group Limited (the parent of Lonestar) (MTN) indicates that a range of 11.5% for its South African and 12.5-13.5% for West and Central African operations (WECO) including an operation in Nigeria (MTN Nigeria), anecdotal evidence indicates that MTN may charge a sizeable premium for funds it makes available to its operations in countries like Liberia. For example, the Consultants understand anecdotally that in 2006 MTN applied for MTN Nigeria a 20% WACC, representing a 5% premium over MTNs estimated WACC at the time of about 15%.

Also, assuming GoL obtains loans from IFIs, GoL is likely to have WACC lower than any operator. If GoL makes funds available to Libtelco or directly to CCL this could reduce the overall WACC of the consortium and therefore the cost of access after financing costs.

6. SUMMARY OF RISKS

The Consultants believe that there are several risks inherent in a decision to proceed with ACE. The following summarizes the most significant of these risks, categorizing them into construction risks, technical risks, pricing risks, financial risks and commercial and regulatory risk.

Despite these risks, the time imperative of ACE and the relative cost to Liberia coupled with the advantages that will flow from having earlier access to international connectivity and broadband capacity than perhaps available from other alternatives, appear from this rapid assessment of facts presented to us and which we were able to assess in the time available, to support a decision to proceed with ACE. As we mention above, any other investment in international connectivity is not going to be without risks, many of which will be identical, and the prejudice that may result to Liberia if it were to miss this opportunity (having regard to the lack of immediate alternatives and the continued high cost of access to SAT-3) appears to outweigh the risks.

These risks have been identified from a review of the issues as a whole, and we have not included a more detailed section in the current version of the Report, preferring to focus on our assessment of the cable and ownership options only, although our next report will consider these risks in greater depth. Appendix A highlights other “risks” in the form of the disadvantages of the ownership structures considered

6.1 Overarching Risks

- Comparison with Other International Connectivity Options. The Consultants understand that of the other (many) satellite, terrestrial (cross-border) and subsea international connectivity options that are available in the area, the GoL and operators consider that the timelines, affordability and terms of participation of ACE are most attractive. However without detailed due diligence, we are not able to confirm that this is in fact the case. We note, for completeness, that the ACE structure is not perhaps optimal in that it requires that operators who are members must take a fixed amount of capacity initially which may bear little relation to need. The short timelines for participating in ACE preclude a more open approach which would approximate the full competitive tender processes mandated by GoL’s procurement laws. Section 7 includes a brief summary of other options for high capacity international connectivity. The Final Report will evaluate each of these options in more detail.
- Value for Money. It is critical to understand whether \$25 million (plus any overruns and ongoing operating and maintenance costs) is a reasonable price to pay for the capacity Liberia will actually obtain via the landing point. The Consultants have calculated a preliminary analysis, summarised below in the Report.
- Other. The massive destruction during the civil conflict of much of Liberia’s national and metro telecommunications infrastructure requires funding for reconstruction of this in order to take up capacity made available by the cable – who will do this? This is also important when considering

support infrastructure to enable further rollout of service, including roads, power, and supporting broadband networks.

- ECOWAS membership requirements. In order to benefit from cross-border relationships and partnerships in construction and trade, Liberia must still comply with certain conditions imposed by ECOWAS.

6.2 Construction and Timing Risks

- Construction and Maintenance Contract Not Finalized. Based on our review of the memoranda of the ACE IMG, it appears that critical aspects of the cable project have not yet been finalized, including available and spare capacity, choice of supplier and date of launch. These could have substantial impact on the cost of construction, actual access to capacity and cost of access. It also could mean that upcoming dates, such as signing of Construction and Maintenance Agreement (CMA) scheduled for April 27 may need to be postponed. The CMA obligates the signatories to pay the full construction cost for each branch of ACE (wet segment) in addition to maintenance and operational costs; \$25 million is simply an estimate of this initial cost – the actual cost could substantially higher (the ACE MOU suggests at Annexure B entitled Investment Model, that the estimated total budget target is around USD500 million). The Consultants understand that the CMA including schedule has not yet been finalized. Will the construction be realistic, or will construction be delayed? The experience of ALCATEL / Lucent in laying the SAT-3 cable provides some assurance that the schedule and costs are reasonable.
- Potential for Cost Overrun. ACE Consortium members are required to guarantee the full cost of the wet segment construction, including (at this point in the negotiations) certain potential cost overruns which is unlikely to be met by the appointed contractors, although careful commercial negotiations could include penalty provisions for overruns and liability for any shortfall. In particular, if the marine survey for ACE has already been completed, the Consultants believe that it would be reasonable for ACE to require the two construction contractors to provide fully guaranteed costed bids, which would substantially limit the exposure of ACE members to cost overruns. Alternatively, it may be possible for additional costs to be funded by third parties in return for equity stakes, though this would dilute the stakes of existing members and therefore we view this as undesirable.
- Components of Cost. The \$25 million cost does not cover future Operations and Maintenance costs, which are calculated as an additional 4% of costs charged each quarter, and the internal and related costs we have described in section 5. The Liberian consortium must also cover the full cost of the actual landing point itself, though this will be reimbursed in full if it costs no more than \$3.5 million (if higher, negotiations are required).
- Guarantees. As mentioned immediately above, ACE requires a guarantee for the entire amount of the branch cost including potential overruns. How can GoL and operators deal with this? Presumably World Bank will provide this, for fee. So on April 27, GoL or operators must give a guarantee for the entire investment including overruns, under the current draft of the ACE MOU.

6.3 Pricing Risks (in Relation to Capacity)

- Role of France Telecom. Once the cable lands in Europe, it is not clear how France Telecom will price the service, or to whom services will be provided, at this point the information in this regard is limited. This risk is mitigated to some extent by the fact that other submarine cables such as SAT-3 and WACS already connect some of the countries with proposed landing points on the ACE cable, the competition from which will assist in controlling prices in general. In addition, France Telecom is obviously constrained by EU competition and pricing principles.

6.4 Structural Risks

- Relationships Among ACE Stakeholders. What are the exact rules of the game between different stakeholders in ACE and the local landing parties? Can they charge differently for the “same” capacity? How will they regulate themselves in relation to breaches by the parties of obligations to one another, and in relation to payment? How will enforcement be achieved? Libtelco’s participation and that of LTA has caused concern among other operators within Liberia, who are not in favour of either party having control over what will be in essence, a strategic national asset. The support of the other operators is of course, critically important to the success of any project to improve international connectivity in Liberia.
- Will ACE Accept GoL as Formal Counterpart? The original MoU was signed by Libtelco, which the Operator Consortium or GoL wants to take over in its own name. Will a transfer of signatory from Libtelco to GoL (or any other party including CCL) require renegotiation of the ACE MoU? Probably not because Libtelco is a GoL entity so Libtelco can assign the contract to GoL. This may be more difficult if CCL steps into Libtelco’s shoes, unless ACE has been kept apprised of developments.

6.5 Commercial Risks

- Timetable. Deadline for membership/payment now and in the future likely to place operators and funders under pressure to make important decisions without appropriate due diligence.
- Formation of Liberian consortium. Formation of a special purpose vehicle (SPV) in which all operators could have representation, will take time and the terms of participation are likely to be contested. Currently we have seen only a consortium agreement; we would expect that once CCL is incorporated the parties should also enter into a shareholders’ agreement and other commercial arrangements to regulate their relationships. These may be contingent on approval by ACE of their participation, and receiving a licence from LTA.
- Libtelco contribution. We have examined this issue in more detail in sections 4.4 and 5.4. given Libtelco’s limited financial resources, consideration could be given to GoL onlending IFI loans to Libtelco or valuing alternative contributions by Libtelco to qualify it for admission to the consortium (such as access to ducts, local loop, etc.). Valuing these contributions will however be difficult and time-consuming. We recommend that if Libtelco pursues this option, it be kept completely separate from negotiation of the CCL, so as not to slow down process on the CCL.
- Rights and obligations. Each operator will be obliged to contribute financially in order to receive its allocated capacity. Libtelco and the smaller mobile operators may struggle to fund their participation. In the case of Libtelco it is unclear whether contributions in kind, such as rights of way or access to infrastructure, may be (or should be) considered to have financial value so as to enable full participation without the same level of actual financial contribution having been made by Libtelco. The smaller licensees may not be able to fund their participation without loans from the other operators or third party funders, which in the time available, may be difficult to obtain. This could prejudice their holding and equity stake within the consortium and ability later to access international capacity.

6.6 Regulatory Risks

- Policy wording and licence conditions. The Policy is presently being revised so the risk that restrictions on technology may hamper operators in owning the cable is likely to be less of a concern or not of concern in the short term. However some changes will be required to operator licences and CCL will need its own licence to enable the consortium to operate the gateway.
- Access terms. Disputes on allocation of capacity and access to infrastructure by way of interconnection or facilities-leasing are likely in the absence of a fair and internationally benchmarked

access regime. Putting this in place in the short term is not ideal because market studies may be appropriate to determine relative market power of operators, along with cost and price analysis.

- Consumer interest not protected. Although wholesale prices for bandwidth can be expected to decline substantially after landing the cable, experience with other African cables indicates that retail prices for broadband access will remain high due to the unwillingness of operators to pass on the cost savings. This will negatively affect the rollout of affordable broadband services to the ordinary citizen unless, as set out above, LTA implements and enforces a robust access and pricing regime to control pricing, use of and access to the cable landing point as an “essential facility”. It will be important for LTA to regulate prices for landing station services so that operators are forced to focus their efforts on building infrastructure to support large scale roll-out of low cost service to as many customers as possible rather than “cream off” profits from high priced service to the few customers who can afford it.
- Operator co-operation. Operators have provided a list of concerns to LTA which summarise the risks they perceive to the success of the cable project, which if not addressed at least in part, are likely to cloud the relationship between GoL, LTA and industry. This would have a negative effect on the project for obvious reasons. We have largely addressed the issues in our assessment and recommendations in this Report. The issues they have mentioned include, for example, lack of clarity about LTA’s role, the absence of a clear definition of a “monopoly” and control mechanisms for a monopoly, little cost information on data transmission, failure to co-ordinate in the past between all operators, and the lack of funding for rollout of broadband transmission infrastructure to rural areas. The operators also recommend a minimum data speed be agreed, and that LTA draft a protocol to underpin the collaboration of the operators in their attempt to create a national backbone network. Note also that some Liberian operators have a history of sometimes rancorous relationships with each other, which may impact their ability to work effectively as partners in CCL.
- Unrealistic industry demands of LTA. Related to the operator concerns are the issues raised by them as being important to the success of the cable project (and we assume, their co-operation with LTA), which may in fact be difficult for LTA to deal with at this point. To some extent these issues also pose risk to the sustainability of Libtelco and so to GoL’s privatisation ambitions. In particular, operators have requested unbundling of the local loop to ensure that incumbents (presumably meaning Libtelco when it develops a local loop) provide access to competitors for local copper loops on fair, reasonable and non-discriminatory terms and grants access at any technically feasible point on the copper loop, including co-location, at cost-based prices. There are some obvious problems with this requirement, not least of which is that Libtelco is struggling to get its CDMA operations off the ground and has low market share – restricting its pricing and terms of access at this stage may be counterproductive. The issues of access to the cable and access to the Libtelco network must not be merged, they involve entirely separate considerations.

7. SCOPE OF THIS REPORT

The Consultants were engaged in March 2010 by IBI International Inc. as part of a USAID-funded project. This report (the Report) provides a rapid assessment of (i) membership in ACE and the ACE submarine cable landing point in Monrovia from a technical, financial and structural perspective, and (ii) structural and ownership options for the Liberian landing point. The Consultants have assumed in this Report a high level of familiarity by the reader both with subsea cables and the ACE project specifically. The Consultants will provide a more comprehensive report shortly, evaluating and comparing ACE with other potential international connectivity options.

8. NEXT STEPS

The Consultants will provide a more comprehensive report shortly, evaluating and comparing ACE with other potential international connectivity options (including other submarine cable, terrestrial and satellite options) and assessing ACE in greater detail. This report will be delivered in approximately two months (*Annex 1 of the Action Plan for the Liberian Gateway to the Global Internet Backbone, or the Final Report*).

The Final Report will build on the work of this report and be based on more extensive data and analysis.

For more information, please visit
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